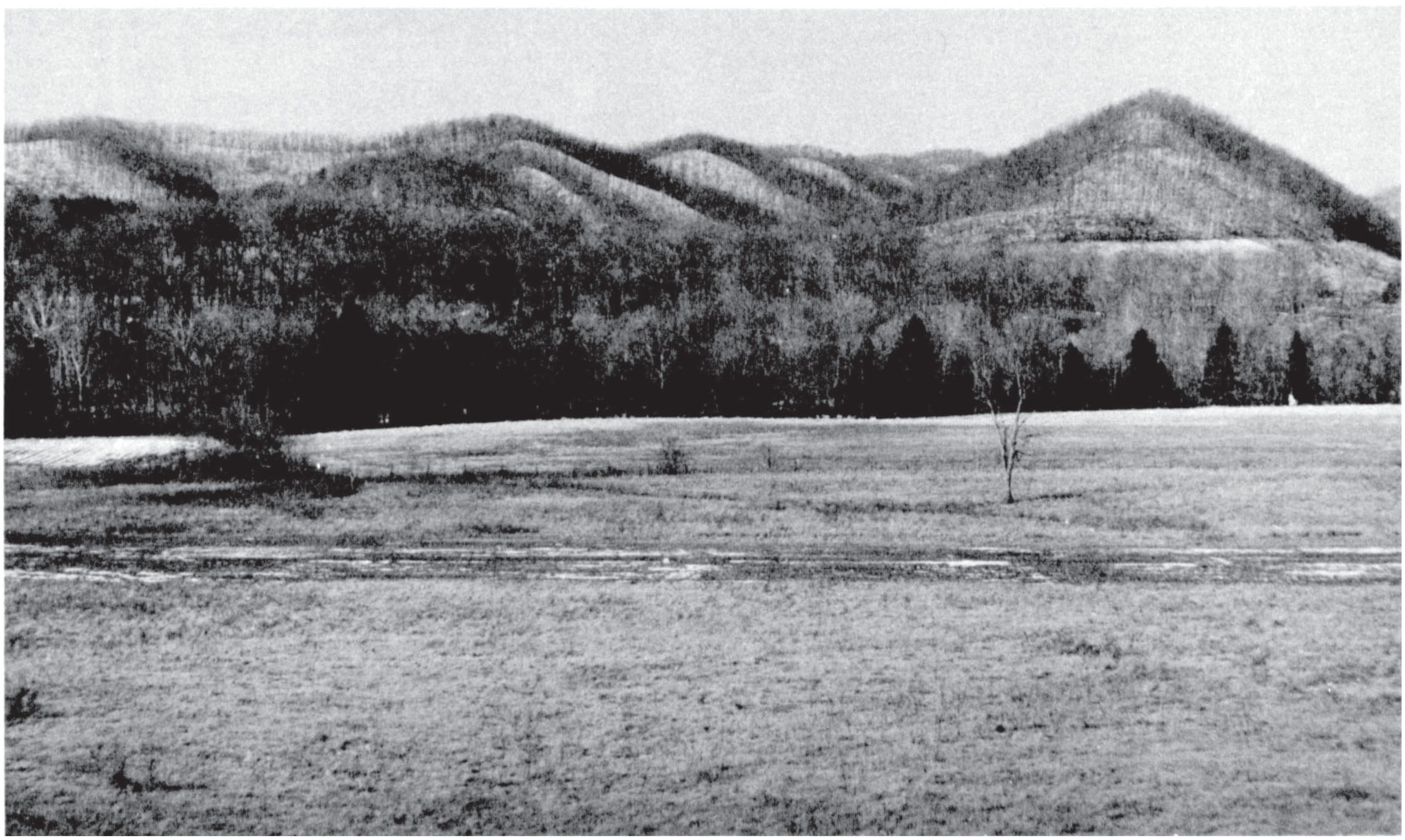
SOIL SURVEY OF

Menifee and Rowan Counties and Northwestern Morgan County, Kentucky



United States Department of Agriculture
Forest Service and Soil Conservation Service
In cooperation with
Kentucky Agricultural Experiment Station

Issued December 1974

Major fieldwork for this soil survey was done in the period 1966–69. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Forest Service, the Soil Conservation Service, and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Menifee County, Rowan County, and Morgan County Soil and Water Conservation Districts.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, forests, and woodlots; in selecting sites for roads, ponds, buildings, and other structures; in managing watersheds; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Menifee and Rowan Counties and about 24,000 acres in the northwestern part of Morgan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, gives the page for the capability unit in which the soil has been placed, and lists the woodland suitability group and wildlife group for each mapping unit.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland groups.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Hydrologists and watershed planners can read about characteristics of the soils that affect absorption of rainwater and runoff in the section "Use of the Soils in Watershed Management."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the section "Town and Country Planning."

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information given in the section "General Nature of the Area."

Cover picture: **A gently sloping Tilsit silt loam in foreground and Cranston and Berks soils on hills in background.**

Contents

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SOIL SURVEY OF MENIFEE AND ROWAN COUNTIES AND NORTHWESTERN MORGAN COUNTY, KENTUCKY

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UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND SOIL CONSERVATION SERVICE, IN COOPERATION WITH KENTUCKY AGRICULTURAL EXPERIMENT STATION

MENIFEE AND ROWAN COUNTIES AND NORTHWESTERN MORGAN COUNTY are on the northwestern edge of the Eastern Kentucky Mountains (fig. 1). About 344,320 acres, or 538 square miles, is in the survey area. Of the total acreage, about 134,400 acres is in Menifee County, 185,600 acres is in Rowan County, and 24,320 acres is in Northwestern Morgan County. The Daniel Boone National Forest occupies 249,523 acres of this survey area. Of this, about 40 percent is administered by the Forest Service and the rest is privately owned.

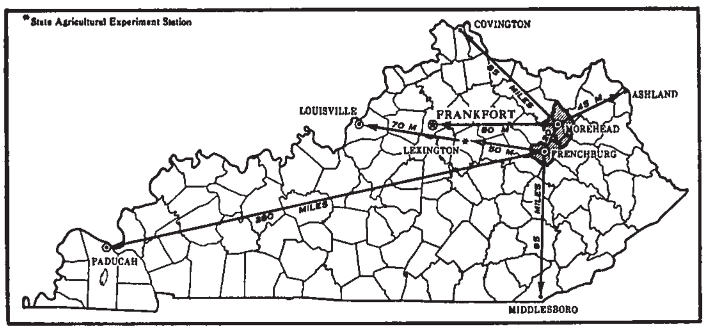

Figure 1.—**Location of Menifee and Rowan Counties and Northwestern Morgan County in Kentucky.**

Frenchburg, Morehead, and West Liberty are the county seats of Menifee, Rowan, and Morgan Counties, respectively. Morehead is the largest of the three towns, and West Liberty is outside the survey area. The major roads in the area are U.S. Highways No. 60 and 460 and Interstate Highway No. 64. Connector roads up valleys and on ridges provide good access to most of this mountainous region. Most settlements and farms are on soils of the bottoms and terraces along major streams and rivers, but some farms and settlements are on broad ridgetops.

About 80 percent of the area is forested, and forest products are the main natural resources. Sawtimber, pine for pulpwood, and hardwoods for charcoal are harvested in the area. Limestone and fire clay are mineral resources that contribute to the economy of the area.

Tobacco is the main cash crop, but corn, hay, and pasture are also important. In Rowan County educational services employ 14 percent of the labor force, mostly because Morehead State University is located there.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cranston and Rigley, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characterstics that affect their behavior on the undisturbed landscape.

Some soils are like the soils in a given series except for at least one differentiating characteristic. If the acreage is small, the soils are called a variant of that series and are given the name of the series as modified by the differentiating feature. An example is the Chavies series, acid variant.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Cranston gravelly silt loam,

2 to 6 percent slopes, is one of several phases within the Cranston series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such mapping unit shown on the soil map of this survey area is the soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Rigley-Donahue complex, 6 to 20 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Strip mines is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilites, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

This soil survey area is adjacent to the following counties, for which soil surveys have been published: Bath County survey, published in 1963, and Elliott County survey, published in 1965. The soil maps do not join with the maps of these published soil surveys because of changes in the concept of some soil series. The mapping units used in this soil survey are also somewhat different from those used in the two earlier soil surveys because different techniques were used in establishing mapping units.

The nine soil associations in this survey area are described on the following pages.

1. Cranston-Berks association

Deep and moderately deep, well-drained, dominantly steep and very steep soils that formed in material weathered from siltstone and shale; on side slopes of narrow ridges

Most of this association is north and south of Morehead, in Rowan County. The deeply dissected landscape consists of very narrow, winding ridgetops; steep to very steep, convex side slopes; and narrow valleys (fig. 2). The soils are underlain by Mississippian acid siltstone and shale, are very strongly acid, and are low to medium in natural fertility.

This association occupies about 17 percent of the survey area. Cranston soils make up about 55 percent of the association; Berks soils, 40 percent; and minor soils, the remaining 5 percent.

Cranston soils formed in colluvium and have a subsoil of brown gravelly silt loam. These are deep soils on the lower one-half to two-thirds of the toe slopes

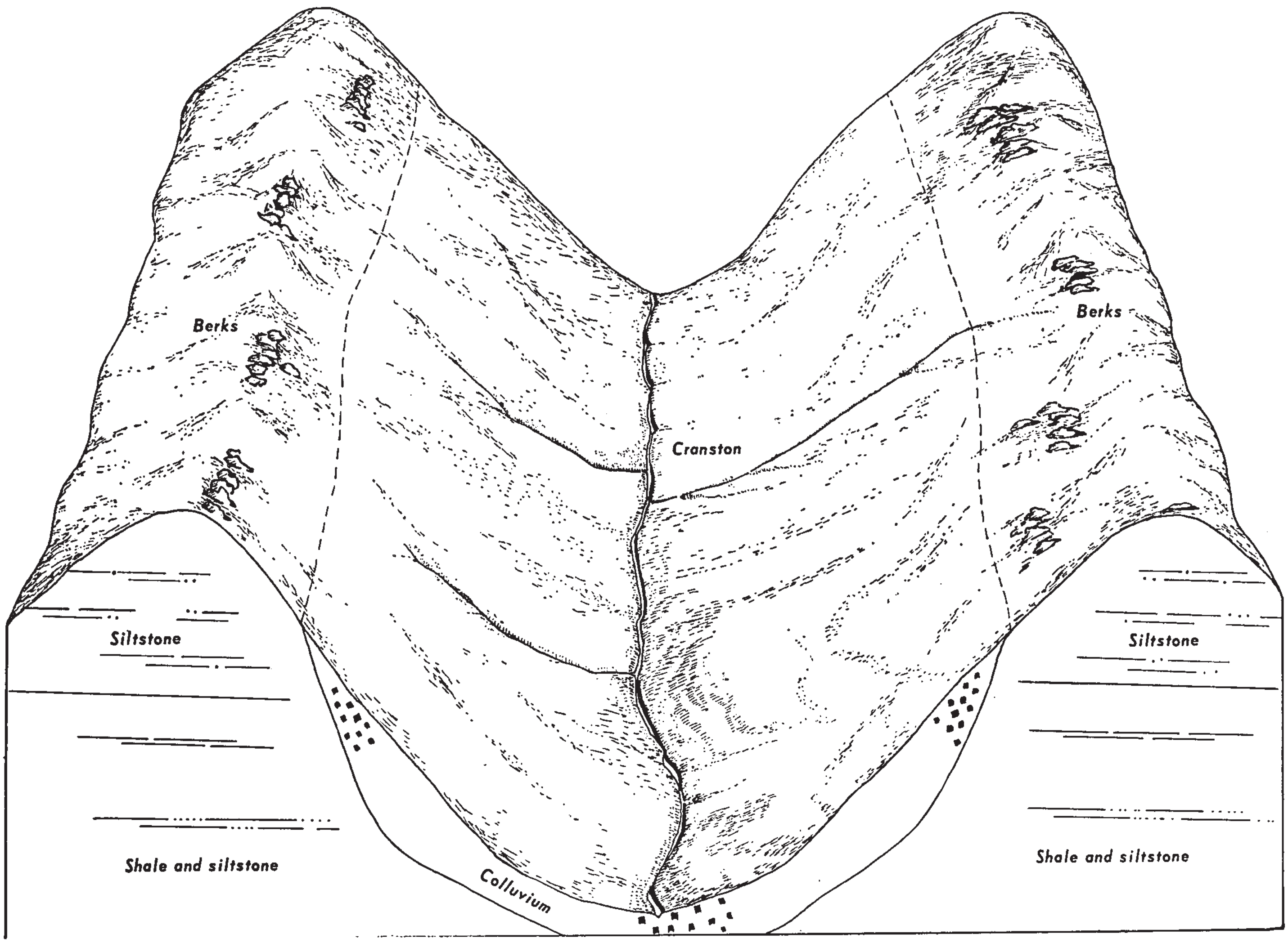

Figure 2.—**Pattern of soils and underlying material in the Cranston-Berks association.**

and side slopes. They range from sloping on the few toe slopes to very steep on the side slopes, but the major part of the acreage is steep or very steep.

Berks soils formed in residuum and have a subsoil of pale-brown and yellowish-brown shaly silt loam that is 40 to 70 percent shale and siltstone fragments. These are moderately deep, steep and very steep soils on the upper third of the side slopes and noses of ridges.

The minor soils in this association are Gilpin soils on uplands and Clifty soils on bottom lands.

This association is mainly forested. A small part is in pasture. The ridges and upper slopes have a cover mainly of chestnut, oak, scarlet oak, hickory, and yellow pine. The lower slopes have a cover mainly of white oak on southern aspects and yellow-poplar on northern aspects. Forest cover is needed for watershed protection because of the hazard of erosion and rapid surface runoff.

This association is managed mainly for woodland and wildlife habitat, and trends suggest that it will continue to be used for these purposes. The soils in this association have severe limitations for most other uses.

2. *Berks-Cranston-Latham association*

Moderately deep and deep, well drained and moderately well drained, sloping to very steep soils that formed in material weathered from siltstone and shale; on side slopes and moderately wide ridgetops.

This association is in the central part of Rowan County, where it extends from the vicinity of Holly Fork southward to the Licking River, and in the western part of Menifee County. The landscape consists of very steep to steep side slopes and sloping to moderately steep ridgetops (fig. 3). The major soils are very strongly acid and low to medium in natural fertility.

This association occupies about 10 percent of the survey area. Berks soils make up about 55 percent of the association; Cranston soils, 25 percent; Latham soils, 15 percent; and minor soils, the remaining 5 percent.

Berks soils formed in shaly and channery residuum and have a pale-brown and yellowish-brown shaly silt loam subsoil. These are moderately deep, very steep soils on upper side slopes and noses of ridges.

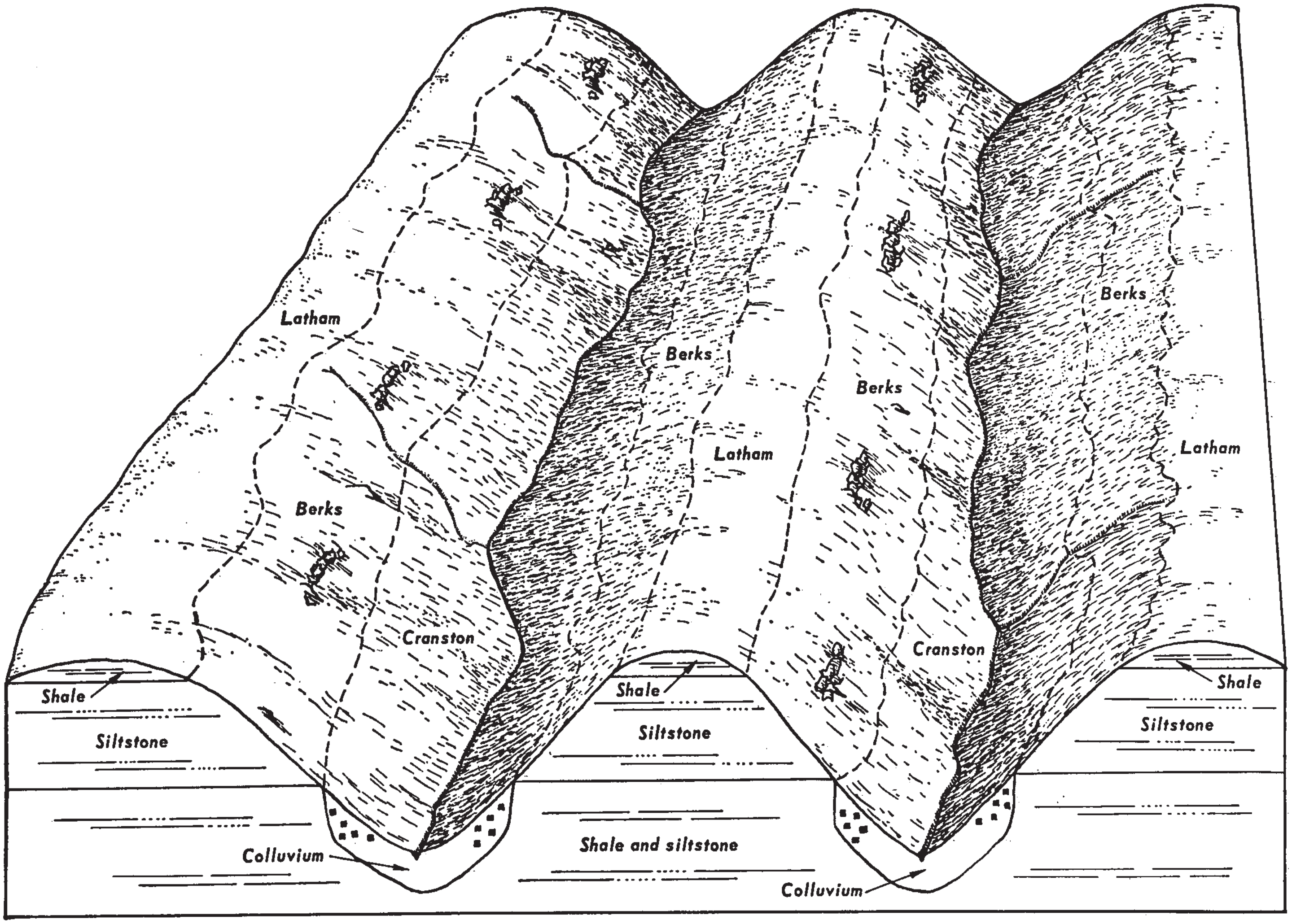

Figure 3.—**Pattern of soils and underlying material in the Berks-Cranston-Latham association.**

Cranston soils formed in gravelly colluvium and have a brownish gravelly silt loam subsoil. These are deep, steep to very steep soils on toe slopes and lower side slopes.

Latham soils formed in residuum from clay shale and have a brownish dominantly silty clay subsoil, mottled with gray in the lower part. These are moderately deep, sloping to moderately steep soils on ridgetops and upper side slopes.

The minor soils in this association are the Gilpin, Donahue, and Hartsells soils on the ridgetops and small acreages of soils on bottom lands.

This association is mostly forested, with chestnut oak and scarlet oak trees on the upper side slopes and mixed oak, hickory, and yellow-poplar on the lower slopes. The ridgetops are mostly covered with oak and hickory. A small part is in pasture. Some formerly cultivated areas are in thick stands of yellow pine.

Limitations are severe for most uses other than woodland and wildlife management in most of this association. The sloping soils, which make up the smaller part of the area, have moderate limitations.

3. *Tilsit-Clifty-Morehead association*

Deep, somewhat poorly drained to well-drained, nearly level to sloping soils that formed in material weathered from siltstone, shale, and sandstone; on bottoms and stream terraces

This association is along Triplett Creek and its North Fork and along the Licking River and its major tributaries in Rowan County; and it is along Beaver, Slate, and Salt Lick Creeks in Menifee County. The landscape consists of broad, nearly level flood plains and nearly level to sloping stream terraces. (fig. 4). The major soils are very strongly acid and are low to medium in natural fertility.

This association occupies about 6 percent of the survey area. Tilsit soils make up about 36 percent of the association; Clifty soils, 15 percent; Morehead soils, 14 percent; and minor soils, the remaining 35 percent.

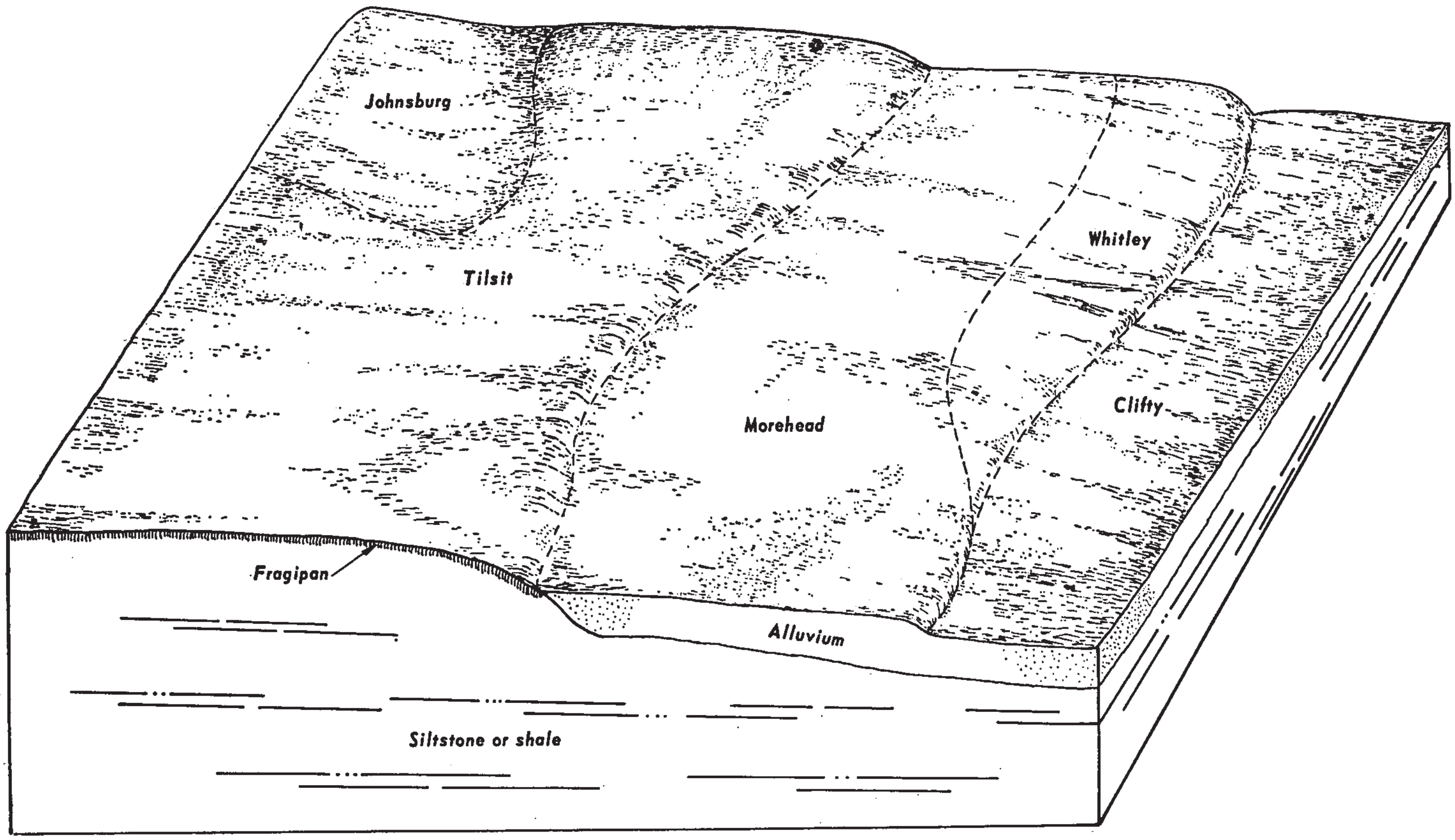

Figure 4.—Pattern of soils and underlying material in the Tilsit-Clifty-Morehead association.

Tilsit soils formed in deep alluvium and have a dominantly yellowish-brown silt loam subsoil. The lower part of the subsoil is a light brownish-gray and olive-brown fragipan that restricts root growth. These are moderately well drained, gently sloping to sloping soils on high stream terraces.

Clifty soils formed in alluvium. They have a thin subsoil that is yellowish-brown silt loam and is underlain by a very gravelly substratum. These are nearly level soils on bottoms.

Morehead soils formed in deep alluvium and have a yellowish-brown silt loam subsoil mottled with gray. These are somewhat poorly drained to moderately well drained, nearly level soils on low terraces.

The minor soils in this association are the Pope, Cuba, Bonnie, Skidmore, and Stendal soils on flood plains and the Whitley and Johnsburg soils on stream terraces. The areas of this association in Menifee County have a higher proportion of Morehead soils than Tilsit soils.

Most of this association is cleared and is used for farming and as sites for buildings. This association has a high potential for farming and for many nonfarm uses, especially where the soils are moderately well drained and well drained. Some fields are reverting to a pine-oak type of cover, and some of the somewhat poorly drained soils are in yellow-poplar, sweetgum, and other bottom-land hardwoods.

The main limitations of the soils in this association are wetness and flooding. The degree of limitation ranges from slight to severe according to the kind of soil and its use.

4. *Latham-Shelocta association*

Moderately deep and deep, moderately well drained and well drained, sloping to steep soils that formed in material weathered from shale and siltstone; on smooth, short side slopes, toe slopes, and moderately wide ridgetops

This association is mostly along the eastern edge of the survey area. A small area is in the western part of Menifee County. The landscape consists of moderately wide ridges and short, smooth side slopes (fig. 5). The soils in this association are very strongly acid and are low in natural fertility.

This association occupies about 25 percent of the survey area. Latham soils make up about 62 percent of the association; Shelocta soils, 25 percent; and minor soils, the remaining 13 percent.

Latham soils formed in residuum from shale and have a brown, dominantly silty clay subsoil mottled with gray in the lower part. These are moderately deep, sloping to steep soils on ridgetops, on noses of ridges, and on short, convex side slopes.

Shelocta soils formed in colluvium from shale and siltstone and have a yellowish-brown and strong-brown

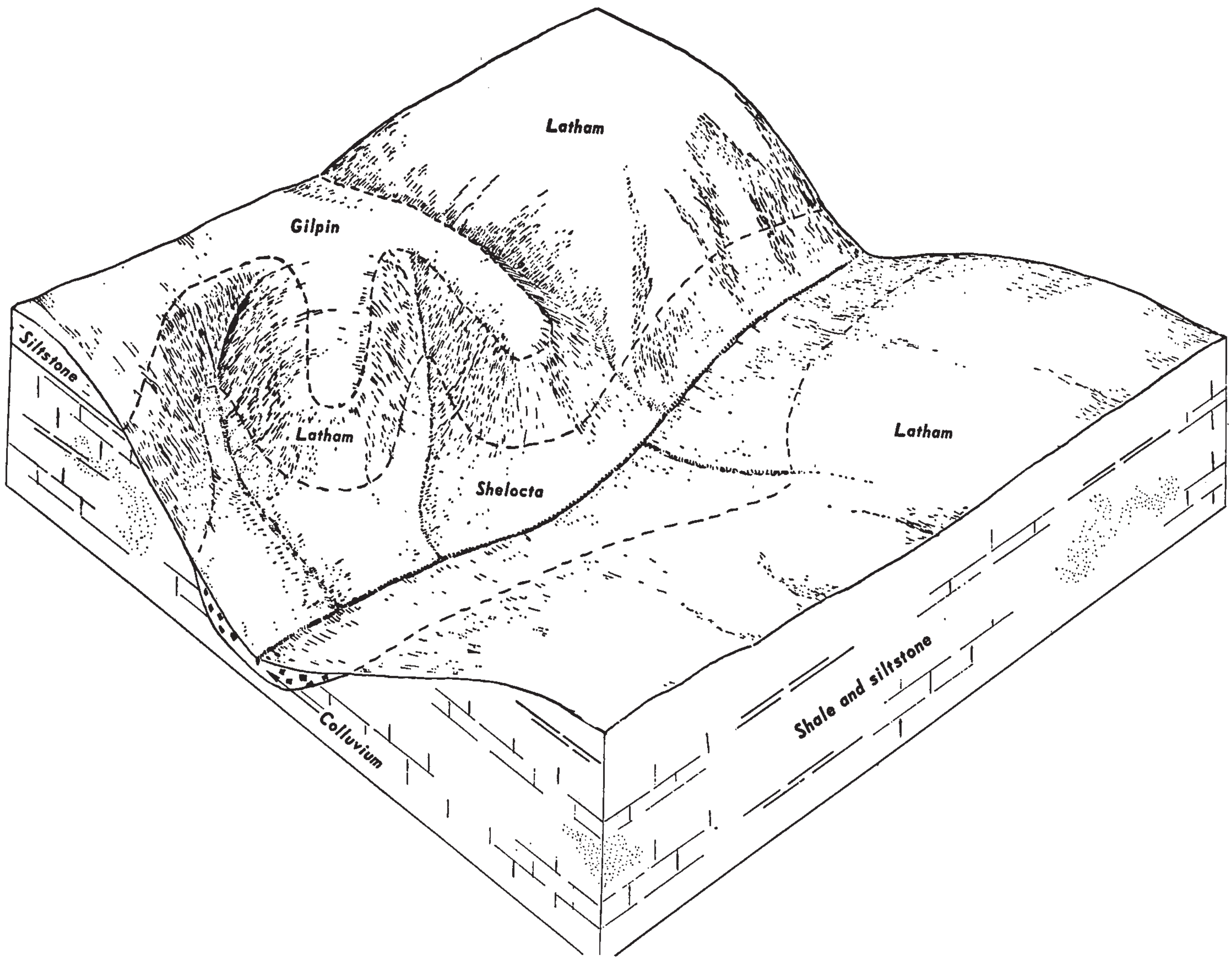

Figure 5.—**Pattern of soils and underlying material in the Latham-Shelocta association.**

dominantly silty clay loam subsoil. These are deep, strongly sloping to steep soils on plane to concave side slopes and toe slopes.

The minor soils in this association are Rigley soils on the steep side slopes, Gilpin and Hartsells soils on the ridges, and other soils on the small bottom lands and on stream terraces. Areas that are strip mined for fire clay occupy a small part of the association.

Most of this association has been cleared and is used for farming. The rest is in woodland, mainly mixed hardwoods and pine trees. Many formerly cultivated areas are in thick stands of yellow pine.

Except for the moderately steep and steep areas, the soils in this association are suitable for farming and for most nonfarm uses, although limitations such as the hazard of erosion, clayey texture, and moderately slow permeability are moderate to severe.

This association can be suitably managed for woodland and wildlife habitat.

5. Rigley-Brookside-Steinsburg association

Deep and moderately deep, well-drained, sloping to very steep soils that formed in material weathered from shale, limestone, or sandstone; on narrow ridgetops and side slopes

This association is in the southeastern part of Rowan County, the northwestern part of Morgan County, and the central part of Menifee County, extending generally southwest from a point south of Elliottville to the Powell County line. The landscape is deeply dissected and is characterized by long, steep, benchy side slopes below sandstone and limestone cliffs and by wide ridgetops and short, rounded side slopes above the cliffs (fig. 6). The major soils are very strongly acid to neutral.

This association occupies about 22 percent of the survey area. Rigley soils make up about 41 percent of the association; Brookside soils, 15 percent; Steinsburg soils, 9 percent; and minor soils, the remaning 35 percent.

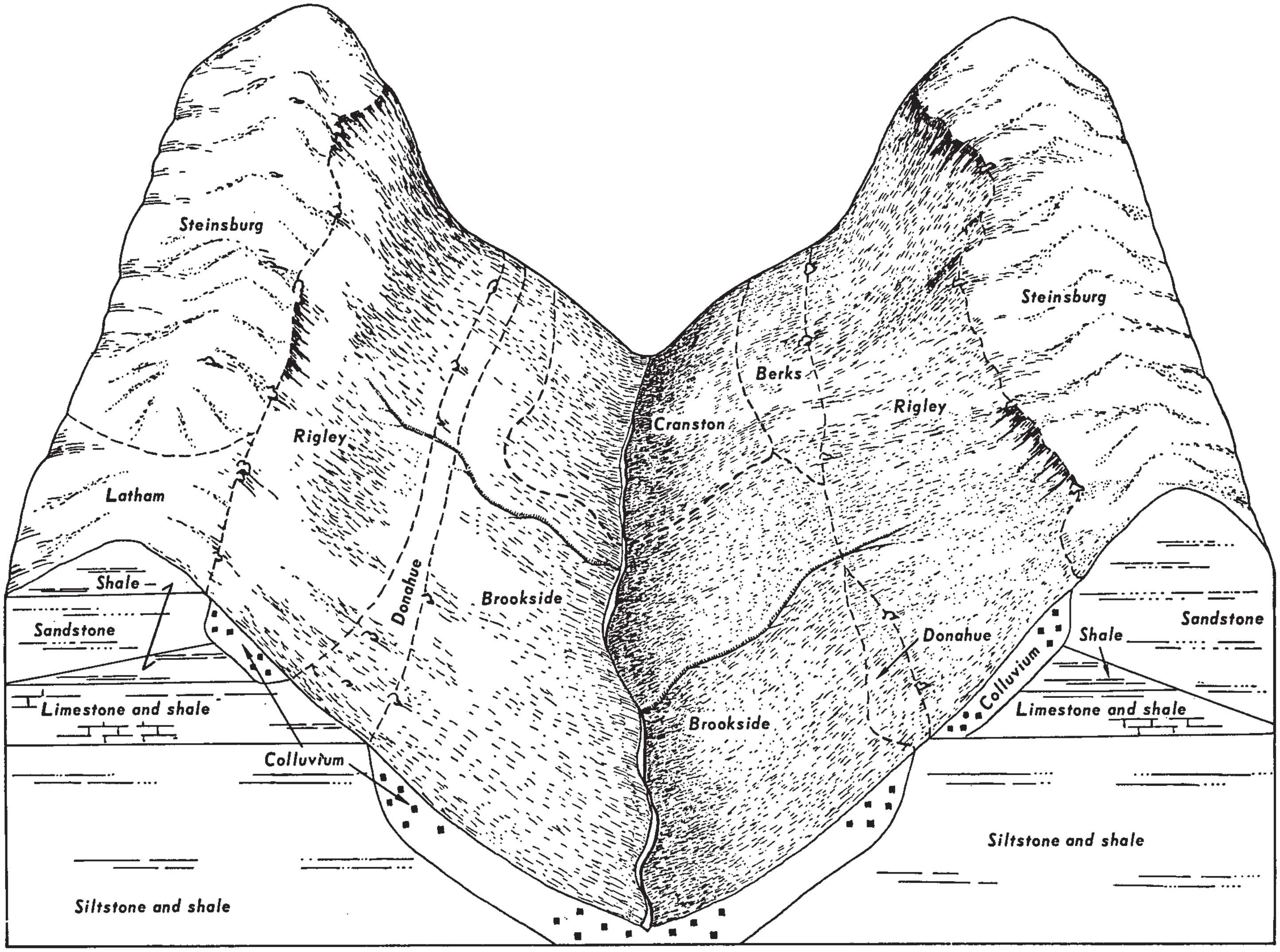

***Figure 6.*—Pattern of soils and underlying material in the Rigley-Brookside-Steinsburg association.**

Rigley soils formed in deep colluvium and have a brown gravelly sandy loam subsoil. The soils are mainly steep to very steep and are on side slopes below sandstone cliffs. Gravel, stones, and boulders cover 5 to 20 percent of the surface in most places.

Brookside soils also formed in deep colluvium and have a dark-brown subsoil that is silty clay loam in the upper part and silty clay in the lower. These steep to very steep stony soils occupy benches and side slopes below limestone cliffs or outcrops.

Steinsburg soils formed in residuum derived from sandstone and have a sandy loam subsoil that is yellowish brown in the upper part and strong brown in the lower. These moderately deep, sloping to steep soils are on ridgetops and short, rounded side slopes above rock cliffs.

The minor soils in this association are Cranston and Berks soils on steep lower side slopes; Donahue soils on steep middle side slopes; Latham, Steinsburg, and Ramsey soils on ridgetops; and small acreage of soils on flood plains and on stream terraces.

This association is mainly forested. The small part that is farmed consists mostly of the sloping to moderately steep areas above the cliffs and the minor soils of the bottoms, stream terraces, and toe slopes.

The major soils are managed mostly for trees and wildlife habitat. They are moderately to severely limited for other uses.

6. Rigley-Cranston-Steinsburg association

Deep and moderately deep, well-drained, gently sloping to very steep soils that formed in material weathered from sandstone, siltstone, and shale; on moderately wide ridgetops, side slopes, and toe slopes

This association is in the east-central and southern parts of Rowan County and in the northern part of Menifee County. It is deeply dissected and consists of soils on benchy side slopes separated from ridgetops by rock cliffs that are generally sandstone (fig. 7). These soils are very strongly acid and have low to medium natural fertility.

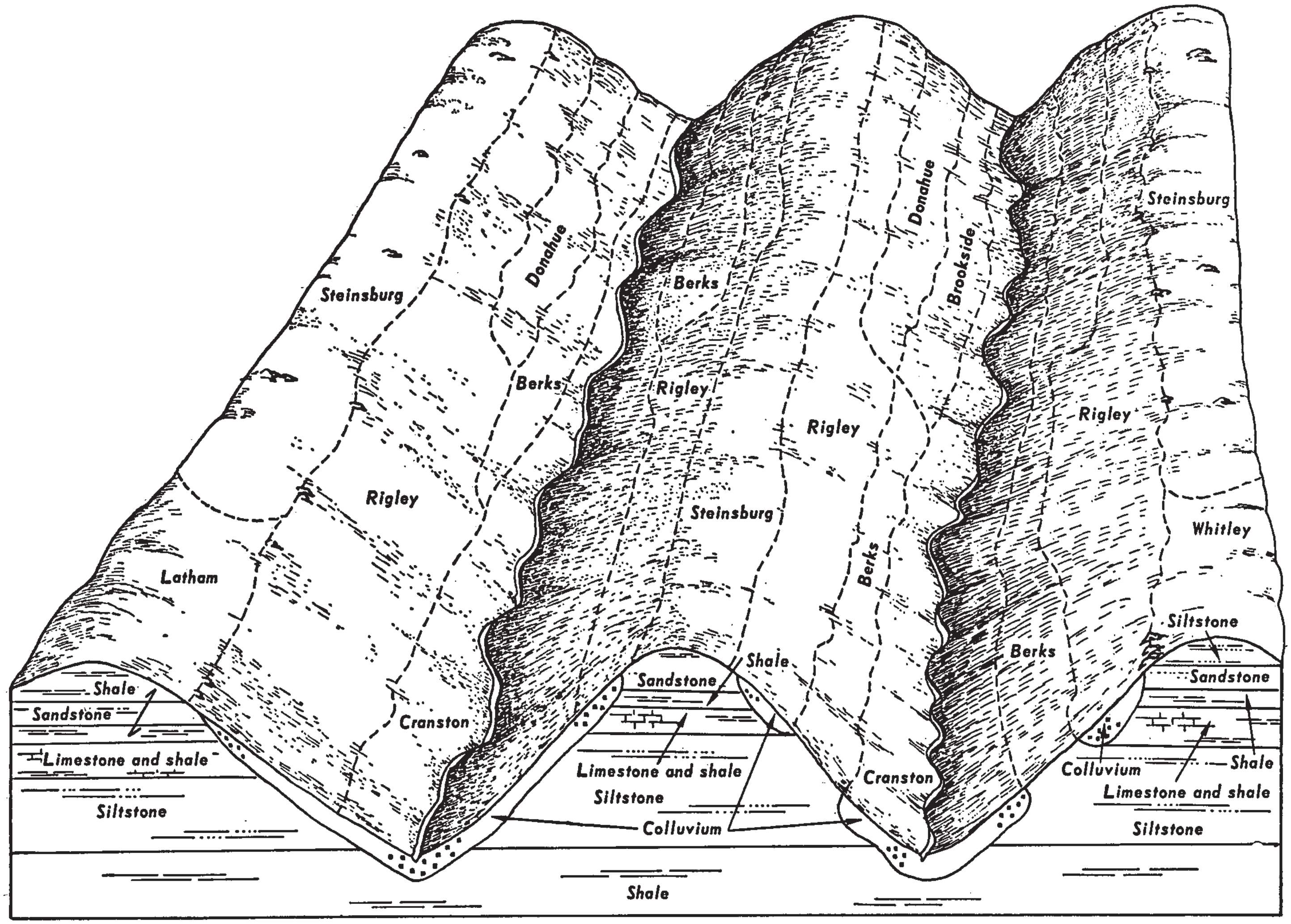

Figure 7.—**Pattern of soils and underlying material in the Rigley-Cranston-Steinsburg association.**

This association occupies about 10 percent of the survey area. Rigley soils make up about 30 percent of the association; Cranston soils, 25 percent; Steinsburg soils, 8 percent; and minor soils, the remaining 37 percent.

Rigley soils formed in deep colluvium and have a brownish gravelly sandy loam subsoil. They are mostly moderately steep to steep and occupy the upper side slopes below the rock cliffs. The steep and very steep areas are stony.

Cranston soils formed in deep colluvium and have a brownish gravelly silt loam subsoil. They are gently sloping to very steep and occupy the lower side slopes and toe slopes.

Steinsburg soils formed in residuum from sandstone and have a sandy loam subsoil that is yellowish brown in the upper part and strong brown in the lower part. These sloping to steep soils are moderately deep and rocky and occupy ridgetops and short, rounded side slopes above the rock cliffs.

The minor soils in this association are Donahue soils on benches; Brookside soils on slopes below limestone outcrops; Berks soils on middle and lower side slopes; Ramsey, Latham, and Whitley soils on ridgetops; and Pope soils on bottom lands.

Most of this association is forested, but some toe slopes, benches, and ridgetops are used for pasture, hay, or row crops. The forest vegetation is largely yellow-poplar, oak, and hickory trees. Some hemlocks and cove hardwoods are below the cliffs. Yellow pine, chestnut oak, and scarlet oak predominate on the ridgetops.

Limitations of most areas of soils in this association for most uses other than woodland and wildlife habitat are severe. Some areas of soils on the ridgetops and toe slopes have slight to moderate limitations for most other uses.

7. *Latham-Tilsit-Johnsburg association*

Moderately deep and deep, moderately well drained and somewhat poorly drained, nearly level to strongly sloping soils that formed in material weathered from shale and siltstone; on broad ridgetops

This association is mainly in the western part of Rowan County in the area locally called Sharkey Flats. Small areas of this association occur near Morehead and

Farmers in Rowan County. The landscape consists of nearly level to strongly sloping, broad ridgetops (fig. 8). The major soils are very strongly acid and have low natural fertility.

This association occupies about 5 percent of the survey area. Latham soils make up about 60 percent of the association; Tilsit soils, 25 percent; Johnsburg soils, 10 percent; and minor soils, 5 percent.

Latham soils formed in residuum derived from shale and have a brown, dominantly silty clay subsoil that is mottled with gray in the lower part. These are moderately deep, moderately well drained, sloping to strongly sloping soils on narrow ridges, knolls, and side slopes above and below areas of nearly level soils.

Tilsit soils formed mostly in residuum and have a dominantly yellowish-brown silt loam subsoil. The lower part of the subsoil is a fragipan that restricts root growth. These are moderately well drained, gently sloping to sloping soils on broad ridgetops.

Johnsburg soils formed mostly in residuum and have a mottled light yellowish-brown and gray silt loam subsoil. At a depth of 15 to 25 inches the subsoil has a fragipan that restricts root growth. These are somewhat poorly drained, nearly level soils in slightly concave areas on broad ridgetops.

The minor soils in this association are Mullins soils in nearly level areas, Gilpin and Whitley soils on ridges and knolls, and other soils on bottom lands and stream terraces.

Most of this association has been cleared and is used for hay, pasture, or row crops. Some old fields have reverted to a pine or pine-oak cover.

The soils in this association are suitable for farming and for most nonfarm uses. The major lmitations are wetness of the nearly level soils, caused by a slowly permeable fragipan; the hazard of erosion; and the clayey subsoil where the soils are sloping and strongly sloping.

8. *Donahue-Latham association*

Moderately deep, well drained and moderately well drained, sloping to steep soils that formed in material weathered from limestone or clay shale; on ridgetops and side slopes

This association is in the south-central part of Rowan County and the northern and western parts of Menifee County. The landscape consists of sloping to strongly sloping, moderately wide to wide ridgetops and short, moderately steep to steep side slopes. Donahue soils are medium acid and medium in natural fertility. Latham soils are very strongly acid and low in fertility.

This association occupies about 3 percent of the survey area. Donahue soils make up about 57 percent of the association; Latham soils, 28 percent; and minor soils, the remaining 15 percent.

Donahue soils formed in residuum from limestone and have a light yellowish-brown to strong-brown, clayey subsoil. These soils are sloping to strongly sloping on ridgetops and moderately steep to steep on side slopes.

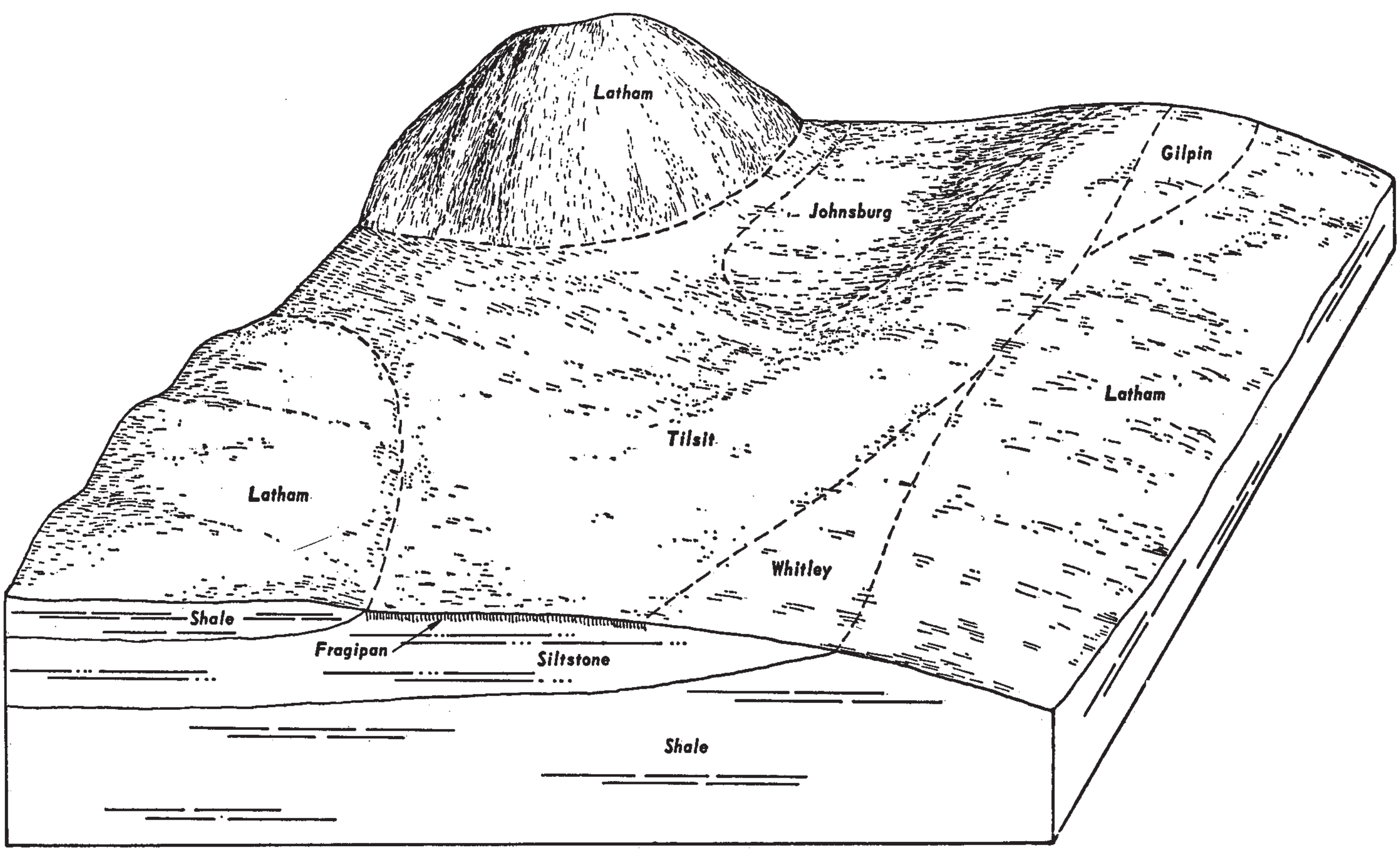

Figure 8.—Pattern of soils and underlying material in the Latham-Tilsit-Johnsburg association.

Outcrops of limestone make up from 10 to 15 percent of the surface.

Latham soils formed in residuum from clay shale and have a dominantly brown silty clay subsoil that has gray mottles in the lower part. These soils are sloping to moderately steep on the lower side slopes and on the knolls that make up part of the ridgetops.

The minor soils in this association are Rigley soils on steep side slopes and Steinsburg soils on caps of knolls. Strip-mined areas where limestone is quarried are also a minor part of this association.

Most areas of this association are forested with upland oak, hickory, ash, walnut, redcedar, and pine trees. Some areas are cleared and are used mostly for pasture and hay.

The major part of this association is better suited to woodland and wildlife habitat than to farming or most other uses because of the steepness and rockiness of the soils.

9. *Muse-Trappist-Latham association*

Deep and moderately deep, well drained and moderately well drained, gently sloping to very steep soils that formed in material weathered from shale; on side slopes, toe slopes, and narrow ridgetops

This association is in the western part of Rowan County. The landscape is characterized by dominantly steep to very steep side slopes (fig. 9). The soils of this association are underlain by black, brittle shale or clay shale, are very strongly acid, and have low natural fertility.

This association occupies about 2 percent of the survey area. Muse soils make up about 47 percent of the association; Trappist soils, 21 percent; Latham soils, 20 percent; and minor soils, the remaining 12 percent.

Muse soils formed in deep colluvium from shale and have a yellowish-red silty clay subsoil. These soils range from gently sloping on toe slopes to steep or very steep

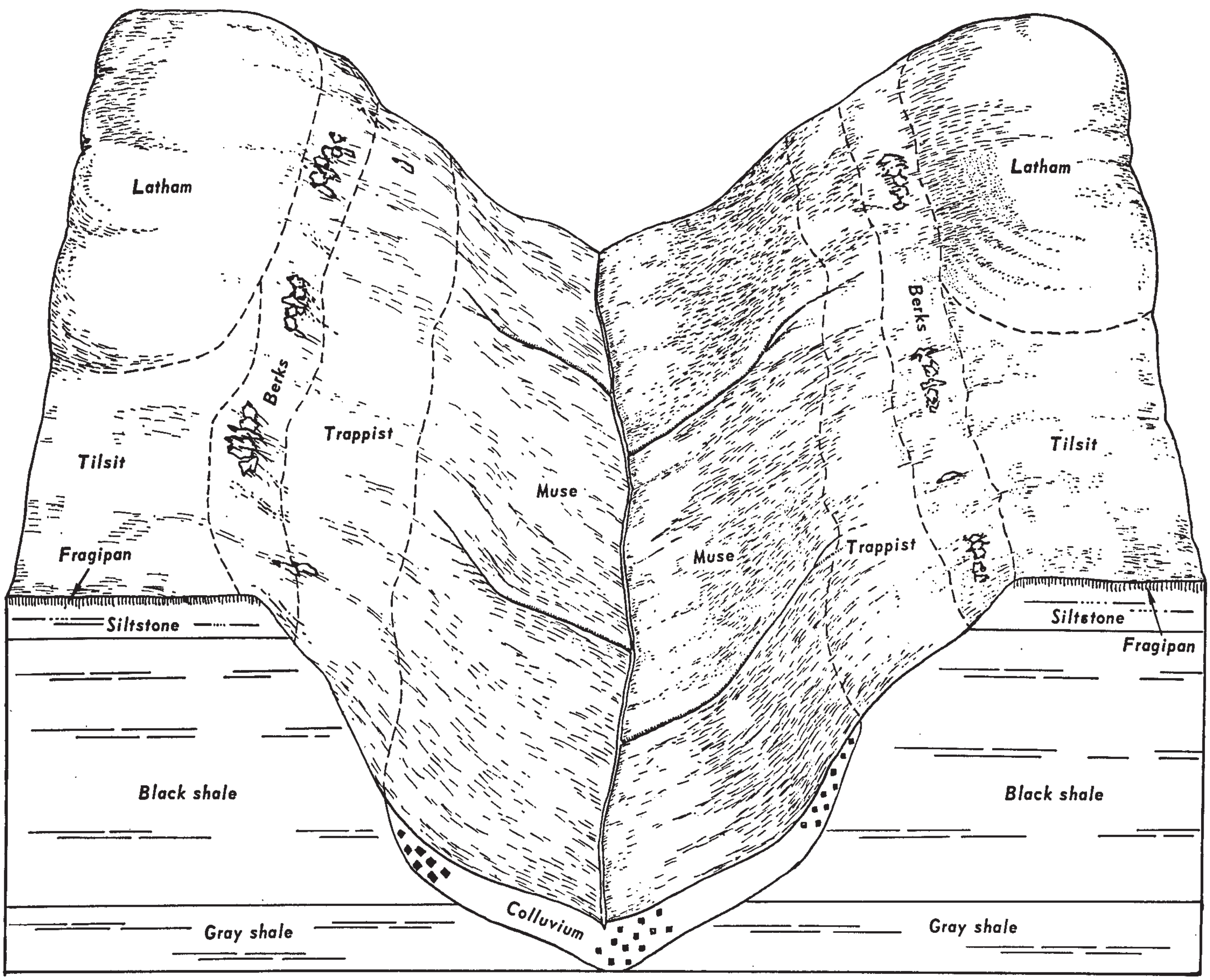

Figure 9.—Pattern of soils and underlying material in the Muse-Trappist-Latham association.

on the side slopes, but they are mainly steep. Most of the steep areas are stony.

Trappist soils formed in residuum from shale and have a strong-brown silty clay subsoil. These soils are moderately deep over hard shale, are steep to very steep, and occupy upper side slopes. Most areas are stony.

Latham soils formed in residuum from clay shale. They have a brown subsoil that is mottled with gray in the lower part and is dominantly silty clay. These soils are moderately deep to soft shale, are sloping to moderately steep, and are on the higher elevations of the ridgetops.

Minor soils in this association are Berks soils on the steep upper side slopes, Tilsit soils on the ridgetops, and other soils of the flood plains and stream terraces.

Most of this association is forested mainly by oak, beech, and hickory on the lower slopes and by chestnut oak, black oak, and Virginia pine on the upper slopes. Virginia pine dominates in areas that were once farmed. Some farming is done on the toe slopes and in other minor areas of nearly level to sloping soils.

This association is better suited to woodland and wildlife habitat than to most other uses because the soils are steep and stony.

Descriptions of the Soils

This section describes the soil series and mapping units in Menifee and Rowan Counties and Northwestern Morgan County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or the differences are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Strip mines, for example, does not belong to a soil series, but nevertheless is listed in alphabetic order with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland suitability group, and wildlife group in which the mapping unit has been placed. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*21*).[1]

Allegheny Series

The Allegheny series consists of deep, well-drained soils on stream terraces and colluvial toe slopes. These soils are very strongly acid. They formed in alluvium and colluvium washed from soils derived from siltstone, sandstone, and shale. Slopes range from 2 to 20 percent.

In a representative profile the surface layer is brown loam about 7 inches thick. The subsoil extends to a depth of 40 inches. The upper part is yellowish-brown loam, the middle part is strong-brown sandy clay loam, and the lower part is strong-brown clay loam. The upper part of the substratum, between depths of 40 and 60 inches, is strong-brown loam. Between depths of 60 to 90 inches, the substratum is yellowish-brown fine sandy loam.

The available water capacity is high, and permeability is moderate. Natural fertility and organic-matter content are medium.

Representative profile of Allegheny loam, 2 to 6 percent slopes, 9 miles south of Morehead, 2 miles east of the junction of State Routes 519 and 1378, in Rowan County:

Ap—0 to 7 inches, brown (10YR 4/3) loam; weak, fine, granular structure; very friable; 1 percent gravel, mostly quartzite pebbles; many fine roots; very strongly acid; clear, smooth boundary.

B1—7 to 18 inches, yellowish-brown (10YR 5/4) loam; weak, fine and medium, subangular blocky structure; very friable; common fine roots; very strongly acid; clear, smooth boundary.

B21t—18 to 31 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, fine and medium, subangular blocky structure; friable; few fine roots; thin, patchy clay films on most peds; very strongly acid; gradual, smooth boundary.

B22t—31 to 40 inches, strong-brown (7.5YR 5/6) clay loam; moderate, fine and medium, angular blocky structure; firm; nearly continuous clay films on peds; few fine root channels; very strongly acid; gradual, smooth boundary.

C1—40 to 60 inches, strong-brown (7.5YR 5/6) loam; weak, coarse, angular blocky structure; friable; thin, patchy clay films; very strongly acid; gradual, smooth boundary.

C2—60 to 90 inches +, yellowish-brown (10YR 5/8) fine sandy loam; massive; very friable; 2 percent coarse fragments in lower half; very strongly acid.

The depth to underlying bedrock is more than 72 inches. The solum ranges from 30 to 40 inches in thickness. Content of coarse fragments in the solum ranges from 0 to 10 percent. The Ap horizon is brown (10YR 4/3) or dark grayish-brown (10YR 4/2) loam or fine sandy loam. The B1 horizon is yellowish brown (10YR 5/4 or 10YR 5/6) or dark yellowish brown (10YR 4/4). The B2t horizon is strong-brown (7.5YR 5/6), yellowish-brown (10YR 5/6), or brown (7.5YR 4/4) sandy clay loam, clay loam, or loam. The C horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/8). In some places the C horizon has common

[1] Italic numbers in parentheses refer to Literature Cited, p. 86.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Menifee County	Rowan County	Northwestern Morgan County	Total area	Total extent
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Allegheny loam, 2 to 6 percent slopes	100	50	20	170	([1])
Allegheny loam, 6 to 12 percent slopes	60	230	100	390	0. 1
Allegheny loam, 12 to 20 percent slopes	40	200	50	290	. 1
Berks silt loam, 40 to 70 percent slopes	8, 760	36, 970	180	45, 910	13. 3
Bonnie silt loam	50	960	([2])	1, 010	. 3
Brookside stony silt loam, 30 to 60 percent slopes	11, 370	530	500	12, 400	3. 5
Chavies fine sandy loam, acid variant, 0 to 6 percent slopes	70	190	10	270	. 1
Clifty silt loam	260	3, 950	([2])	4, 210	1. 2
Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes	250	([2])	([2])	250	. 1
Cranston gravelly silt loam, 2 to 6 percent slopes	350	800	([2])	1, 150	. 3
Cranston gravelly silt loam, 6 to 12 percent slopes	390	2, 260	40	2, 690	. 8
Cranston gravelly silt loam, 12 to 20 percent slopes	210	2, 520	([2])	2, 730	. 8
Cranston gravelly silt loam, 20 to 30 percent slopes	200	1, 300	20	1, 520	. 4
Cranston gravelly silt loam, 30 to 60 percent slopes	8, 520	37, 460	600	46, 580	13. 5
Cuba silt loam	270	2, 530	([2])	2, 800	. 8
Donahue rocky sandy loam, 6 to 20 percent slopes	1, 690	1, 670	130	3, 490	1. 0
Donahue rocky sandy loam, 20 to 40 percent slopes	810	1, 550	60	2, 420	. 7
Gilpin silt loam, 6 to 12 percent slopes	470	1, 440	20	1, 930	. 6
Gilpin silt loam, 12 to 20 percent slopes	180	1, 840	70	2, 090	. 6
Hartsells fine sandy loam, 6 to 12 percent slopes	820	560	80	1, 460	. 4
Hartsells fine sandy loam, 12 to 20 percent slopes	610	810	290	1, 710	. 5
Johnsburg silt loam	160	1, 860	10	2, 030	. 6
Latham silt loam, 6 to 12 percent slopes	6, 030	4, 770	460	11, 260	3. 3
Latham silt loam, 12 to 20 percent slopes	8, 870	10, 250	3, 430	22, 550	6. 6
Latham silt loam, 20 to 30 percent slopes	2, 580	3, 420	([2])	6, 000	1. 7
Latham-Shelocta silt loams, 12 to 20 percent slopes	2, 830	670	430	3, 930	1. 1
Latham-Shelocta silt loams, 20 to 30 percent slopes	17, 090	11, 550	6, 200	34, 840	10. 0
Latham-Shelocta silt loams, 30 to 50 percent slopes	15, 230	6, 520	640	22, 390	6. 5
Monongahela fine sandy loam, 2 to 6 percent slopes	100	270	20	390	. 1
Morehead silt loam	1, 140	1, 760	30	2, 930	. 8
Mullins silt loam	10	490	([2])	500	. 1
Muse silt loam, 2 to 6 percent slopes	([2])	210	([2])	210	. 1
Muse silt loam, 6 to 12 percent slopes	([2])	360	([2])	360	. 1
Muse silt loam, 12 to 20 percent slopes	([2])	470	([2])	470	. 1
Muse silt loam, 20 to 30 percent slopes	([2])	250	([2])	250	. 1
Muse-Trappist stony silt loams, 30 to 60 percent slopes	([2])	3, 720	([2])	3, 720	1. 1
Pope fine sandy loam	130	1, 530	320	1, 980	. 6
Pope gravelly fine sandy loam	50	680	([2])	730	. 2
Renox gravelly fine sandy loam, 2 to 6 percent slopes	360	10	([2])	370	. 1
Renox gravelly fine sandy loam, 6 to 15 percent slopes	240	([2])	([2])	240	. 1
Rigley gravelly fine sandy loam, 2 to 6 percent slopes	100	180	([2])	280	. 1
Rigley gravelly fine sandy loam, 6 to 12 percent slopes	130	80	([2])	210	. 1
Rigley gravelly fine sandy loam, 12 to 20 percent slopes	190	150	40	380	. 1
Rigley gravelly fine sandy loam, 20 to 30 percent slopes	1, 120	790	460	2, 370	. 7
Rigley stony fine sandy loam, 30 to 60 percent slopes	18, 890	9, 350	2, 440	30, 680	8. 9
Rigley-Donahue complex, 6 to 20 percent slopes	40	200	([2])	240	. 1
Rigley-Donahue complex, 20 to 30 percent slopes	1, 020	670	230	1, 920	. 6
Rigley-Donahue complex, 30 to 60 percent slopes	6, 440	3, 810	3, 370	13, 620	4. 0
Skidmore gravelly fine sandy loam	2, 370	370	30	2, 770	. 8
Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes	470	470	10	950	. 3
Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes	8, 060	3, 070	1, 880	13, 010	3. 8
Stendal silt loam	960	1, 690	([2])	2, 650	. 8
Stendal fine sandy loam, neutral variant	530	30	([2])	560	. 2
Strip mines	90	1, 040	260	1, 390	. 4
Tilsit silt loam, 2 to 6 percent slopes	980	7, 640	200	8, 820	2. 6
Tilsit silt loam, 6 to 12 percent slopes	320	3, 270	([2])	3, 590	1. 0
Whitley silt loam, 6 to 12 percent slopes	1, 100	740	1, 170	3, 010	. 9
Whitley silt loam, 12 to 20 percent slopes	10	200	([2])	210	. 1
Whitley silt loam, terrace, 0 to 2 percent slopes	30	1, 470	([2])	1, 500	. 4
Whitley silt loam, terrace, 2 to 6 percent slopes	60	860	30	950	. 3
Whitley silt loam, terrace, 6 to 12 percent slopes	70	160	([2])	230	. 1
Cave Run Reservoir	1, 120	2, 750	490	4, 360	1. 3
Total	134, 400	185, 600	24, 320	344, 320	100. 0

[1] Less than 0.05 percent.

[2] Less than 5 acres.

mottles of light gray (10YR 7/2) or pale brown (10YR 6/3). The C horizon ranges from loam to sandy loam. Coarse fragments range from 0 to 20 percent in the C horizon

Allegheny soils occur near Cranston, Monongahela, and Rigley soils. They have more sand but fewer coarse fragments than Cranston soils. Allegheny soils are better drained than Monongahela soils and lack the fragipan of those soils. They have fewer coarse fragments and more clay in the B horizon than Rigley soils.

Allegheny loam, 2 to 6 percent slopes (AlB).—This soil is on high stream terraces. It has the profile described as representative for the series. Included in mapping are small areas of Monongahela soils and of a soil that has a thicker combined surface layer and subsoil than this Allegheny soil.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to all of the commonly grown cultivated crops, to hay, and to pasture. It is also suited to trees and wildlife habitat. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe-1; woodland suitability group 2o1; wildlife group 1.

Allegheny loam, 6 to 12 percent slopes (AlC).—This soil is on high stream terraces and slightly convex alluvial fans. Included in mapping are small areas of Latham and Monongahela soils and of a soil that has a thicker combined surface layer and subsoil than this Allegheny soil.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to most cultivated crops, to hay, and to pasture. It is also suited to trees and wildlife habitat. If the soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-1; woodland suitability group 2o1; wildlife group 1.

Allegheny loam, 12 to 20 percent slopes (AlD).—This soil is on toe slopes and short, convex and concave side slopes. Included in mapping are small areas of Latham and Rigley soils.

This soil is easy to till, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil can be cultivated occasionally, but it is better suited to hay or pasture than to cultivated crops. Trees and wildlife habitat are also suitable uses. This soil is highly susceptible to erosion if cultivated. Capability unit IVe-1; woodland suitability group 2o1; wildlife group 2.

Berks Series

The Berks series consists of moderately deep, well-drained soils on ridges and side slopes. These soils are very strongly acid. They formed in residuum derived from siltstone. Slopes range from 40 to 70 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 3 inches thick. The subsoil is pale-brown shaly silt loam to a depth of 11 inches and yellowish-brown shaly silt loam to a depth of 24 inches. The underlying material, which extends to a depth of 32 inches, is yellowish-brown shaly silt loam. Bedrock is at a depth of 32 inches.

The available water capacity is low, and permeability is moderately rapid. Natural fertility and organic-matter content are low.

Representative profile of Berks silt loam, 40 to 70 percent slopes, up Rock Fork on Forest Service Road 117, about 6 miles from State Route 377, in Rowan County:

O11—½ to ⅛ inch, hardwood leaves and twigs.

O12—⅛ inch to 0, partially decomposed leaves and twigs.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; 10 percent shale and siltstone fragments; many roots; very strongly acid; abrupt, smooth boundary.

B1—3 to 11 inches, pale-brown (10YR 6/3) shaly silt loam; weak, fine and very fine, subangular blocky structure; very friable; 15 percent shale and siltstone fragments; many roots; very strongly acid; clear, wavy boundary.

B2—11 to 24 inches, yellowish-brown (10YR 5/6) shaly silt loam; weak, fine, subangular blocky structure; very friable; 50 percent shale and siltstone fragments; common roots; common very fine pores; very strongly acid; gradual, wavy boundary.

C—24 to 32 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak, coarse, granular structure to massive; very friable; 65 percent shale and siltstone fragments; few roots; very strongly acid; abrupt, irregular boundary.

R—32 inches, siltstone bedrock.

Depth to siltstone is typically about 32 inches but ranges from 20 to 38 inches. The solum ranges from 18 to 32 inches in thickness. The A1 horizon is dark grayish brown (10YR 4/2), light olive brown (2.5Y 5/4), or dark brown (10YR 4/3). The B2 and C horizons are light olive brown (2.5Y 5/4) or yellowish brown (10YR 5/4 or 10YR 5/6). Content of coarse fragments in these horizons ranges from 40 to 70 percent. Horizontal bedding of the siltstone is evident in the C horizon in many places.

Berks soils are near Cranston and Gilpin soils. They have more coarse fragments in the solum than Cranston and Gilpin soils. They are not so deep to bedrock as Cranston Soils.

Berks silt loam, 40 to 70 percent slopes (BeF).—This soil is mostly on upper side slopes and ridges. Stones, rock outcrops, and boulders generally cover less than 5 percent of the surface, but in some places they cover as much as 10 percent. Some areas of this soil are on lower side slopes, where rock outcrops generally are more common. Where this soil is below limestone outcrops, it is less acid than is typical.

Included with this soil in mapping are small areas of Cranston and Gilpin soils. Also included are a soil that is extremely acid in the surface layer and a soil, on very narrow ridgetops and near rock outcrops, that is more shallow to bedrock than this Berks soil.

The effective depth for root growth ranges from 20 to 38 inches. This soil is droughty.

Very steep slopes and rapid runoff severely limit the use of this soil. It is suited to a permanent forest cover that will provide good wildlife habitat and watershed protection. The hazard of erosion is very severe. Capability unit VIIe-1; woodland suitability group 3f2 on north-facing slopes and 4f1 on south-facing slopes; wildlife group 4.

Bonnie Series

The Bonnie series consists of deep, poorly drained soils on flood plains. These soils are very strongly acid. They formed in alluvium washed from soils derived from acid shale and siltstone and are on the first bottoms along most of the streams. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is 3 inches thick. It is dark grayish-brown silt loam that has very

dark grayish-brown and yellowish-red mottles. The subsoil extends to a depth of about 28 inches. The upper 7 inches is gray silt loam that has yellowish-red mottles, and the lower 18 inches is gray silt loam that has dark brown mottles. The substratum extends to a depth of 75 inches or more. The upper 32 inches is gray heavy silt loam that has yellowish-brown mottles, and the lower part is yellowish-brown heavy silt loam that has gray mottles.

The available water capacity is high, and permeability is moderate. Natural fertility is medium, and organic-matter content is low.

Representative profile of Bonnie silt loam, about 1 mile north of Farmers, on State Route 801, about 3½ miles west on State Route 1722, about 60 yards to left in old field, in Rowan County:

Ap—0 to 3 inches, dark grayish-brown (2.5Y 4/2) silt loam; common, medium, distinct mottles of very dark grayish brown (2.5Y 3/2) and yellowish red (5YR 4/6); moderate, fine, granular structure; very friable; many roots; very strongly acid; clear, wavy boundary.

B1g—3 to 10 inches, gray (5Y 5/1) silt loam; common, coarse, distinct, mottles of yellowish red (5YR 4/6); weak, medium, granular to weak, fine, subangular blocky structure; friable; common roots; very strongly acid; clear, wavy boundary.

B2g—10 to 28 inches, gray (5Y 6/1) heavy silt loam; common, medium, distinct, mottles of dark brown (7.5YR 4/4); weak, fine and medium, subangular blocky structure; wet and sticky; few roots; very strongly acid; gradual, wavy boundary.

C1g—28 to 44 inches, gray (5Y 5/1) heavy silt loam; common, medium, prominent mottles of yellowish brown (10YR 5/6); massive; wet and sticky; few roots; very strongly acid; gradual, wavy boundary.

C2g—44 to 60 inches, gray (N 5/0) heavy silt loam; many medium, prominent mottles of yellowish brown (10YR 5/6); massive; wet and sticky; few roots; very strongly acid; gradual, wavy boundary.

C3—60 to 75 inches +, yellowish-brown (10YR 5/6) heavy silt loam; many, medium, prominent mottles of gray (N 6/0); massive; sticky; few roots; very strongly acid.

Depth to underlying bedrock is 72 inches or more. The solum ranges from 25 to 36 inches in thickness. Content of gravel in any place is less than 2 percent. The A horizon is dark grayish brown (2.5Y 4/2 or 10YR 4/2), grayish brown (2.5Y 5/2), and olive gray (5Y 5/2). The Bg horizon is gray (5Y 5/1 or 5Y 6/1), light gray (5Y 7/1), light olive gray (5Y 6/2), or grayish brown (2.5Y 5/2).

Bonnie soils are near Stendal and Mullins soils. They are more poorly drained than the somewhat poorly drained Stendal soils. They lack the fragipan of Mullins soils.

Bonnie silt loam (0 to 2 percent slopes) (Bo).—This soil is on flood plains. Included in mapping are small areas of Cuba and Stendal soils and small, permanently wet areas.

This soil is poorly drained and has a seasonal high water table above a depth of ½ foot, which limits the effective depth for root growth during winter and spring. If an adequate drainage system is provided, the response of crops to lime and fertilizer is good. This soil is easy to till when it is not too wet. It is frequently flooded.

This soil is better suited to plants that tolerate wetness than to other plants, but if adequate drainage is provided, the soil is suited to trees, pasture, or hay. If drained, this soil is also suited to most of the commonly grown cultivated crops except tobacco. Capability unit IIIw-1; woodland suitability group 1w1; wildlife group 6.

Brookside Series

The Brookside series consists of deep, well-drained, stony soils on uplands. These soils are neutral. They formed mainly in colluvium washed from soils derived from limestone, but a minor component washed from soils derived from siltstone, sandstone, and shale. These soils are on the side slopes of mountainlike ridges. Slopes range from 30 to 60 percent.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 39 inches thick. The upper 8 inches is dark-brown silty clay loam, the next 9 inches is dark-brown heavy silty clay loam, and the lower 22 inches is dark-brown silty clay that has dark-brown and yellowish-brown mottles. The substratum, which reaches a depth of 60 inches, is yellowish-brown heavy clay loam that has light brownish-gray, yellowish-brown, and dark-brown mottles.

The available water capacity is high, and permeability is moderately slow. Natural fertility is high, and organic-matter content is medium.

Representative profile of Brookside stony silt loam, 30 to 60 percent slopes, about 9 miles south of Morehead, about ½ mile north of Poppin Rock Tunnel on State Route 519, then west about 20 feet, in Rowan County:

O1—1 inch to 0, grass and hardwood leaves.

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; very friable; 5 percent stones and gravel; many roots; neutral; abrupt, smooth boundary.

B1t—7 to 15 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 2 percent gravel; common roots; neutral; clear, wavy boundary.

B21t—15 to 24 inches, dark-brown (7.5YR 4/4) heavy silty clay loam; moderate, fine and very fine, subangular blocky structure; firm; distinct, patchy clay films on peds; 3 percent gravel; common roots; neutral; clear, wavy boundary.

B22t—24 to 35 inches, dark-brown (7.5YR 4/4) silty clay; few, fine, faint mottles of dark brown (10YR 3/3) and yellowish brown (10YR 5/4); moderate, very fine, subangular blocky structure; firm; distinct, patchy clay films on peds; 3 percent gravel; few roots; neutral; gradual, wavy boundary.

B3t—35 to 46 inches, dark-brown (7.5YR 4/4) silty clay; few, medium, faint mottles of dark brown (10YR 3/3) and yellowish brown (10YR 5/6); weak, fine and very fine, subangular blocky structure; firm; faint, patchy clay films on peds; 3 percent gravel; few roots; neutral; clear, wavy boundary.

C—46 to 60 inches +, yellowish-brown (10YR 5/4) heavy clay loam; few, medium, faint mottles of light brownish gray (10YR 6/2), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/2); weak, fine, subangular blocky structure to massive; firm; 5 percent gravel; few roots; neutral.

Depth to bedrock is 60 inches or more. The solum ranges from 40 to 54 inches in thickness. Content of coarse fragments is 2 to 10 percent, by volume, in the A and B horizons. The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The texture is stony silt loam or stony silty clay loam. The A1 horizon, where present, is 2 to 5 inches thick and is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The Bt horizon ranges from dark brown (7.5YR 4/4) to yellowish brown (10YR 5/6). The B2t and B3t horizons range from heavy silty clay loam to clay. The C horizon ranges from reddish-brown (5YR 4/4) to olive (5Y 5/6) heavy clay loam to clay. The C horizon is 2 to 25 percent coarse fragments in some places.

Brookside soils are near Rigley, Cranston, and Donahue soils. They are less acid and contain more clay throughout

the profile than Rigley and Cranston soils. They are deeper than Donahue soils.

Brookside stony silt loam, 30 to 60 percent slopes (BrF).—This soil is on side slopes and on some benches. It is normally below limestone outcrops. Stones cover 2 to 10 percent of the surface.

Included with this soil in mapping are small areas of Rigley, Donahue, and Cranston soils. Also included are some areas of soils that have 10 to 20 percent slopes on benches and other soils that are 48 to 60 inches deep to bedrock. The texture of the subsoil ranges from sandy clay loam to clay loam in some places.

The effective depth for root growth is 60 inches or more.

Most areas of this soil are wooded, but a few are used for pasture. The steepness and stoniness of the soil make it unsuited to cultivation and to hay. Pasture is difficult to establish and maintain. This soil is suited to woodland and wildlife habitat. The hazard of erosion is very severe. Capability unit VIIs–1; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Chavies Series, Acid Variant

The Chavies series, acid variant, consists of deep, well-drained soils on second bottoms on flood plains. These soils are strongly acid to very strongly acid. They formed in alluvium washed from soils derived from acid sandstone and shale. Slopes range from 0 to 6 percent.

In a representative profile the surface layer is dark-brown fine sandy loam about 9 inches thick. The subsoil is 36 inches thick. The upper 6 inches is yellowish-brown fine sandy loam, the next 8 inches is dark-brown fine sandy loam, the next 11 inches is strong-brown fine sandy loam, and the lower 11 inches is strong-brown sandy loam. The substratum extends to a depth of 65 inches or more. The upper 11 inches is yellowish-brown sandy loam, and the lower 9 inches is yellowish-brown loam that has light-gray, strong-brown, and dark yellowish-brown mottles.

The available water capacity is high, and permeability is moderately rapid. Natural fertility and organic-matter content are medium.

Representative profile of Chavies fine sandy loam, acid variant, 0 to 6 percent slopes, about 2 miles south of U.S. Highway 60 on State Route 801, 350 yards south of State Route 801 near the Licking River, in Rowan County:

Ap—0 to 9 inches, dark-brown (10YR 4/3) fine sandy loam; weak, medium, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B1—9 to 15 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, subangular blocky structure; friable; many roots; common very fine pores; strongly acid; clear, wavy boundary.

B21t—15 to 23 inches, dark-brown (7.5YR 4/4) fine sandy loam; moderate, medium, subangular blocky structure; friable; common roots; distinct, patchy clay films; common very fine pores; very strongly acid; clear, wavy boundary.

B22t—23 to 34 inches, strong-brown (7.5YR 5/6) fine sandy loam; moderate, fine and medium, subangular blocky structure; friable; common roots; distinct, discontinuous clay films; common very fine pores; very strongly acid; gradual wavy boundary.

B3—34 to 45 inches, strong-brown (7.5YR 5/6) sandy loam; weak, fine and medium, subangular blocky structure; friable; few roots; few very fine pores; very strongly acid; gradual, wavy boundary.

C1—45 to 56 inches, yellowish-brown (10YR 5/6) sandy loam; massive; loose; few roots; very strongly acid; gradual, wavy boundary.

C2—56 to 65 inches +, yellowish-brown (10YR 5/6) loam; many, medium, distinct mottles of light gray (10YR 7/2), strong brown (7.5YR 5/6), and dark yellowish brown (10YR 4/4); massive; friable; very strongly acid.

Depth to the underlying bedrock is more than 72 inches. The solum ranges from 40 to 48 inches in thickness. Content of gravel in the lower part of the subsoil is 5 to 10 percent in some places. The Ap horizon is dark-brown (10YR 4/3) or dark yellowish-brown (10YR 4/4) fine sandy loam, sandy loam, or loam. The B and C horizons range from dark-brown (7.5YR 4/4) to yellowish-brown (10YR 5/6) fine sandy loam, sandy loam, or loam. In some places the B3 and C horizons are clay loam.

Chavies soils are near Pope, Rigley, and Whitley soils. They have a B horizon of clay accumulation that is lacking in Pope soils. They have fewer coarse fragments in the solum than Rigley soils. They are coarser textured throughout than Whitley soils.

Chavies fine sandy loam, acid variant, 0 to 6 percent slopes (ChB).—This soil is on second bottoms along rivers and creeks that drain large watersheds.

Included with this soil in mapping are small areas of Whitley, Pope, and Morehead soils. In some places the lower part of the subsoil is sandy clay loam.

This soil is easily tilled, and response of crops to lime and fertilizer is good. Effective depth for root growth is 48 inches or more. Flooding is a hazard in some places.

This soil is suited to most cultivated crops and to hay and pasture. It is also well suited to woodland and wildlife habitat. If this soil is cultivated, the hazard of erosion is slight. Capability unit I–2; woodland suitability group 2o1; wildlife group 8.

Clifty Series

The Clifty series consists of deep, well-drained soils on flood plains. These soils are very strongly acid. They formed in loamy material 18 to 30 inches thick over gravel. Slopes range from 0 to 4 percent.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The subsoil, which extends to a depth of 18 inches. is yellowish-brown silt loam. This is underlain by a gravelly substratum that is about 40 percent pebbles and cobblestones 1/4 inch to 6 inches in diameter and yellowish-brown silt loam soil material. Bedrock is at a depth of about 50 inches.

The available water capacity is low. Permeability is moderate in the upper part and rapid in the gravel layer. Natural fertility and organic-matter content are low.

Representative profile of Clifty silt loam, 2½ miles from State Route 377, on Elk Lick Fork road, 50 feet east in a white pine plantation, in Rowan County:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; common roots; 10 percent gravel; common fine and very fine pores; very strongly acid; smooth, wavy boundary.

B2—9 to 18 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; few roots; 2 percent gravel; common fine and very fine pores; very strongly acid; clear, irregular boundary.

C—18 to 50 inches, gravel and yellowish-brown (10YR 5/4) silt loam interstitial material; massive; loose; few roots; 40 percent pebbles and cobblestones 1/4 inch to 6 inches in diameter; very strongly acid.

R—50 inches +, siltstone.

Depth to bedrock ranges from 40 to 72 inches or more. Thickness of the solum and the depth to fragmental layers range from 18 to 30 inches. The Ap horizon is dark brown (10YR 4/3) or dark yellowish brown (10YR 4/4). The A1 horizon, where present, is 3 to 4 inches thick and is dark brown (10YR 4/3 or 10YR 3/3). Content of gravel in the A horizon ranges from 0 to 20 percent. The B2 horizon is yellowish brown (10YR 5/4), brown (10YR 4/3 or 10YR 5/3), or dark yellowish brown (10YR 4/4). Content of gravel in the B horizon ranges from 0 to 20 percent. The C horizon is 25 to 50 percent gravel and is yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), or brown (10YR 4/3 or 10YR 5/3).

Clifty soils are near Cranston, Renox, and Cuba soils. They lack a B horizon of clay accumulation, which is typical of Cranston and Renox soils. They have more coarse fragments in the C horizon than Cuba soils.

Clifty silt loam (0 to 4 percent slopes) (Ck).—This soil is on flood plains.

Included with this soil in mapping are small areas of Cranston and Renox soils. Also included are small areas of a soil that is similar to Clifty soils but is more than 50 percent gravel below a depth of 18 inches and small areas of a soil that has a surface layer of fine sandy loam.

This soil is easily tilled, except where the surface layer is more than 15 percent gravel. Effective depth for root growth is limited to the depth to the gravel layer because of the very low available water capacity in the gravel. The response of crops to lime and fertilizer is generally good, although this soil is droughty.

This soil is suited to trees and to most of the commonly grown cultivated crops. It is also suited to hay and pasture. The rapidly permeable substratum causes a potential pollution hazard when this soil is used for disposal of polluted liquids or solid waste. If this soil is cultivated, the hazard of erosion is slight. Most areas of this soil are subject to stream overflow. Fall-seeded crops are subject to damage by flooding in winter and early in spring. Capability unit IIs-1; woodland suitability group 3f1; wildlife group 8.

Cotaco Series, Neutral Variant

The Cotaco series, neutral variant, consists of deep, moderately well drained soils on second bottoms and alluvial fans. These soils are neutral in the upper part of the profile. They formed in alluvium washed from soils derived from sandstone, limestone, and shale. Slopes range from 2 to 6 percent.

In a representative profile the surface layer is dark-brown fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of 35 inches, is yellowish brown and has light brownish-gray, dark yellowish-brown, yellowish-brown, very pale brown, dark-brown, and light-gray mottles. The upper 7 inches is fine sandy loam, and the lower 22 inches is loam. The underlying material is yellowish-brown gravelly loam that has very dark grayish-brown and light brownish-gray mottles.

The available water capacity is high, and permeability is moderate. Natural fertility is medium, and organic-matter content is low.

Representative profile of Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes, about 3½ miles from State Route 36 on State Route 1274, about 500 yards across Beaver Creek at old homesites, in Menifee County:

Ap—0 to 6 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine and medium, granular structure; very friable; 4 percent gravel; many roots; neutral; clear, smooth boundary.

B1—6 to 13 inches, yellowish-brown (10YR 5/4) fine sandy loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4); weak, fine, subangular blocky structure; very friable; 4 percent gravel; many roots; neutral; clear, smooth boundary.

B2t—13 to 23 inches, yellowish-brown (10YR 5/4) loam; common, medium, distinct mottles of yellowish brown (10YR 5/6), very pale brown (10YR 7/3), and light brownish gray (10YR 6/2); weak, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 5 percent gravel; few roots; neutral; clear, smooth boundary.

B3—23 to 35 inches, yellowish-brown (10YR 5/4) loam; common, coarse, distinct mottles of dark brown (10YR 3/3) and light gray (10YR 7/2); weak, fine, subangular blocky structure; friable; 10 percent gravel; few roots; slightly acid; clear, smooth boundary.

C—35 to 50 inches +, yellowish-brown (10YR 5/4) gravelly loam; common, medium, distinct mottles of very dark grayish brown (10YR 3/2) and light brownish gray (10YR 6/2); massive; friable; 25 percent gravel; slightly acid.

Depth to bedrock ranges from about 48 to 72 inches or more. The solum ranges from 30 to 40 inches in thickness. Content of gravel in the solum ranges from 2 to 25 percent. The Ap and B1 horizons are fine sandy loam or loam. The B1 horizon is yellowish brown (10YR 5/4) or dark brown (10YR 4/3). The B2t horizon is mostly yellowish brown (10YR 5/4 or 10YR 5/6). About 10 to 40 percent of the B horizon has mottles that are 2 or less in chroma. The B3 horizon is loam, sandy clay loam, or clay loam. The C horizon is yellowish brown (10YR 5/4), grayish brown (10YR 5/2), or gray (10YR 5/1). The B3 and C horizons are slightly acid to neutral.

Cotaco soils are near Renox soils and Stendal soils, neutral variant. They are not so well drained as Renox soils. They have a B horizon of clay accumulation, which Stendal soils, neutral variant, lack.

Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes (CoB).—This soil is on low terraces and alluvial fans. Included in mapping are small areas of Renox soils and Stendal soils, neutral variant.

This soil is easily tilled, and response of crops to fertilizer is good. Lime is not needed, because this soil is neutral. The effective depth for root growth is restricted by a seasonal high water table.

This soil is well suited to woodland, pasture, and hay production. If this soil is cultivated, the hazard of erosion is moderate. Drainage is needed in most areas for cultivated crops to grow well. Most areas of this soil are cleared, but some areas are forested. Capability unit IIw-2; woodland suitability group 2w1; wildlife group 7.

Cranston Series

The Cranston series consists of deep, well-drained, gravelly soils on side slopes of ridges and on colluvial fans. These soils are medium acid to very strongly acid. They formed in colluvium washed from soils derived from acid siltstone and shale. Slopes range from 2 to 60 percent.

In a representative profile the surface layer is brown gravelly silt loam about 5 inches thick. The subsoil is gravelly silt loam that extends to a depth of 50 inches. It is light yellowish brown in the upper part, yellowish brown in the middle part, and brown in the lower part. The underlying material is yellowish-brown gravelly silt loam that extends to a depth of 76 inches or more.

The available water capacity is medium, and permeability is moderately rapid. Natural fertility is medium.

Representative profile of Cranston gravelly silt loam, 30 to 60 percent slopes, 3 miles north of the Poppin Rock Tunnel at Paragon on State Route 519, 300 yards east in a ravine, in Rowan County (Laboratory No. S67KY-103-1):

O11—1½ inches to ½ inch, hardwood leaves and twigs.
O12—½ inch to 0, partially decomposed leaves and twigs.
A1—0 to 5 inches, brown (10YR 4/3) gravelly silt loam; weak, fine, granular structure; very friable; many roots; 25 percent gravel; medium acid; clear, smooth boundary.
B1—5 to 13 inches, light yellowish-brown (10YR 6/4) gravelly silt loam; weak, fine subangular blocky structure parting to weak, coarse, granular; very friable; common roots; 20 percent gravel; few fine pores; very strongly acid; clear, wavy boundary.
B21t—13 to 23 inches, yellowish-brown (10YR 5/4) gravelly silt loam; weak, very fine, subangular blocky structure; friable; few roots; common thin clay films on peds; 30 percent gravel; few roots; few fine pores; strongly acid; clear, wavy boundary.
B22t—23 to 31 inches, yellowish-brown (10YR 5/4) gravelly silt loam; moderate, fine, subangular blocky structure; friable; few roots; common thin clay films on peds; 15 percent gravel; strongly acid; clear, wavy boundary.
B3t—31 to 50 inches, brown (7.5YR 5/4) gravelly silt loam; weak, very fine, subangular blocky structure; friable; few roots; few thin clay films on peds; 15 percent gravel; common small cavities; very strongly acid; gradual, wavy boundary.
C—50 to 76 inches +, yellowish-brown (10YR 5/4) gravelly silt loam; massive; friable; few roots; 23 percent gravel and channery fragments; very strongly acid.

Depth to acid siltstone or shale bedrock is 48 inches or more. The solum ranges from 40 to 60 inches in thickness. The A horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), or dark yellowish brown (10YR 4/4). The B1 horizon is light yellowish brown (10YR 6/4) or yellowish brown (10YR 5/4 or 10YR 5/6), and the B2t horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6). Content of coarse fragments in the B2 horizon ranges from 12 to 30 percent, by volume. The B3 and C horizons have the same color range as the B2t horizon, but they commonly have more gravel than the overlying horizons and have gray mottles in some places.

Cranston soils occur near Tilsit, Berks, Rigley, and Brookside soils. They are better drained and have more coarse fragments throughout than Tilsit soils. They are deeper and have fewer coarse fragments throughout than Berks soils. Cranston soils have less sand in the solum than Rigley soils. They are less clayey in the B horizon and have more coarse fragments than Brookside soils.

Cranston gravelly silt loam, 2 to 6 percent slopes (CrB).—This soil is on alluvial fans and toe slopes. It has a profile similar to the one described as representative for the series, but the subsoil generally contains slightly more clay and is less yellow.

Included with this soil in mapping are small areas of Whitley and Clifty soils. Also included are some soils that are not gravelly in the surface layer.

This soil is somewhat difficult to till, because it contains gravel. The organic-matter content is medium, and response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to trees and to all of the commonly grown cultivated crops. It is also suited to hay and to pasture. Most areas are cleared. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe-3; woodland suitability group 2o1; wildlife group 1.

Cranston gravelly silt loam, 6 to 12 percent slopes (CrC).—This soil is on alluvial fans and toe slopes. It has a profile similar to the one described as representative for the series, but the subsoil has slightly more clay and is less yellow. Included in mapping are small areas of Whitley, Tilsit, and Clifty soils.

This soil is somewhat difficult to till, because it contains gravel. The organic-matter content is low, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to trees and to all of the commonly grown cultivated crops. It is also suited to hay and to pasture. Most areas are cleared. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-4; woodland suitability group 2o1; wildlife group 1.

Cranston gravelly silt loam, 12 to 20 percent slopes (CrD).—This soil is on toe slopes. Included in mapping are small areas of Gilpin and Whitley soils.

This soil is somewhat difficult to till, because it contains gravel. The organic-matter content is low, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to hay, pasture, and trees. It can also be cultivated occasionally. If this soil is cultivated, the hazard of erosion is very severe. Capability unit IVe-1; woodland suitability group 2o1; wildlife group 2.

Cranston gravelly silt loam, 20 to 30 percent slopes (CrE).—This soil is on smooth, convex side slopes and toe slopes. Included in mapping are small areas of Gilpin, Latham, and Shelocta soils.

The effective depth for root growth is 48 inches or more. The organic-matter content is low.

This soil is not suited to cultivation, because it is steep and is subject to damage from erosion. It is suited to pasture or to trees and wildlife habitat. Most areas are forested. Capability unit VIe-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Cranston gravelly silt loam, 30 to 60 percent slopes (CrF).—This soil is on concave lower side slopes. It has the profile described as representative for the series. Included in mapping are small areas of Gilpin, Berks, and Shelocta soils.

The effective depth for root growth is 48 inches or more. The organic-matter content is low.

This soil is not suited to cultivation, because it is subject to soil loss as a result of runoff. It is better suited to trees and wildlife habitat than to pasture or hay because of the difficulty of operating farm machinery and of establishing a stand. Capability unit VIIe-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Cuba Series

The Cuba series consists of deep, well-drained soils on flood plains. These soils are strongly acid or very strongly acid, except in the surface layer where it has been limed. They formed in alluvium washed from soils derived from acid shale and siltstone. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil extends to a depth of 44 inches. The upper 12 inches is dark yellowish-brown silt loam, the next 7 inches is olive-brown silt loam, and the lower 17 inches is yellowish-brown silt loam. The substratum is dominantly yellowish-brown silt loam that extends to a depth of 85 inches or more.

The available water capacity is high, and permeability is moderate. Natural fertility and organic-matter content are medium.

Representative profile of Cuba silt loam, about 2 miles west of State Route 32, north on dirt road just past Interstate Highway 64, about 100 feet north in field between North Fork of Triplett Creek and Interstate Highway 64, in Rowan County:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; common roots; few very fine pores; slightly acid; clear, smooth boundary.

B1—8 to 20 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, granular structure; very friable; common roots; few very fine pores, strongly acid; clear, wavy boundary.

B21—20 to 27 inches, olive-brown (2.5Y 4/4) silt loam, weak, fine, subangular blocky structure; friable; few roots; common very fine pores; strongly acid; gradual, wavy boundary.

B22—27 to 44 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine, subangular blocky structure; friable, sticky when wet; few roots; few very fine pores; very strongly acid; gradual, wavy boundary.

C—44 to 85 inches +, yellowish-brown (10YR 5/6) silt loam; massive; friable, sticky when wet; very strongly acid.

Depth to bedrock ranges from 48 to 72 inches or more. The solum ranges from 35 to 45 inches in thickness. Gravel makes up as much as 5 percent of the solum in some places. The Ap horizon is dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). It is typically strongly acid or very strongly acid unless limed. The B and C horizons are dark yellowish brown (10YR 4/4), brown (10YR 4/3), yellowish brown (10YR 5/4 or 10YR 5/6), or olive brown (2.5Y 4/4). The C horizon is stratified silt loam and sandy loam that has an admixture of hard shale or sandstone fragments. Mottles 2 or less in chroma are below a depth of 27 inches in some places.

Cuba soils occur near Pope and Whitley soils. They contain less sand than Pope soils. They lack the B horizon of clay accumulation of Whitley soils.

Cuba silt loam (0 to 2 percent slopes) (Cu).—This soil is on flood plains. Included in mapping are small areas of Morehead and Whitley soils and a small acreage of a soil that has gray mottles between depths of 20 and 27 inches.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is suited to most of the commonly grown cultivated crops. It is also suited to trees, pasture, and hay. Nearly all of this soil is cleared. Small grain sown in fall is subject to damage by occasional flooding in winter and early in spring. If this soil is cultivated, the hazard of erosion is slight. Capability unit I-1; woodland suitability group 1o1; wildlife group 8.

Donahue Series

The Donahue series consists of moderately deep, well-drained, stony or rocky soils on toe slopes and side slopes below sandstone cliffs on uplands. These soils are very strongly acid in the upper part of the profile and medium acid to neutral in the lower part. They formed in residuum derived from sandstone, limestone, and shale. Slopes range from 6 to 60 percent.

In a representative profile the surface layer is grayish-brown sandy loam about 4 inches thick. The subsoil is 30 inches thick. The upper 5 inches is light yellowish-brown loam, the next 6 inches is yellowish-brown clay loam, the next 7 inches is strong-brown silty clay that has brown mottles, and the lower 12 inches is strong-brown clay that has yellowish-brown and yellowish-red mottles. Limestone bedrock is at a depth of 34 inches.

The available water capacity is medium, and permeability is moderately slow. Natural fertility is medium, and organic-matter content is low.

Representative profile of a Donahue sandy loam from an area of Rigley-Donahue complex, 30 to 60 percent slopes, about 12 miles northeast of Frenchburg, 1/4 mile north of Leatherwood Creek, 2 1/2 miles west of State Route 826, in Menifee County:

O1—1/2 inch to 0, partially decomposed hardwood leaves and twigs.

Ap—0 to 4 inches, grayish-brown (10YR 5/2) sandy loam; weak, medium, granular structure; very friable; common roots; 3 percent sandstone fragments; very strongly acid; clear, smooth boundary.

B1—4 to 9 inches, light yellowish-brown (10YR 6/4) loam; weak, fine, subangular blocky structure; very friable; common roots; 2 percent sandstone fragments; very strongly acid; clear, wavy boundary.

B21t—9 to 15 inches, yellowish-brown (10YR 5/6) clay loam; moderate, fine, subangular blocky structure; firm; few roots; 4 percent sandstone fragments; common thin clay films; strongly acid; clear, wavy boundary.

IIB22t—15 to 22 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, faint mottles of brown (10YR 4/3); moderate, medium, angular blocky structure; firm; few roots; many thin clay films; few, small, brown and black concretions and stains; medium acid; gradual, wavy boundary.

IIB3t—22 to 34 inches, strong-brown (7.5YR 5/6) clay; common, medium, faint mottles of yellowish brown (10YR 5/4) and yellowish red (5YR 4/6); weak, fine, angular blocky structure; very firm; few roots; common thin clay films; few brown and black concretions and stains; neutral; abrupt, smooth boundary.

R—34 inches +, limestone bedrock.

Depth to limestone or shale bedrock is 24 to 40 inches. The solum ranges from 20 to 40 inches in thickness. The Ap horizon is brown (10YR 4/3), yellowish-brown (10YR 5/4), or grayish-brown (10YR 5/2 or 2.5Y 5/2) sandy loam, loam, or fine sandy loam. The B21t horizon ranges from yellowish-brown (10YR 5/6) to reddish-brown (5YR 4/4) clay loam or sandy clay loam. The IIBt horizon ranges from brown (7.5YR 4/4) to yellowish-red (5YR 5/6) silty clay or clay. In some places there is a C horizon that is strong-brown (7.5YR 5/6), dark-brown (7.5YR 4/4), or light olive-brown (2.5Y 5/4) clay or silty clay.

Donahue soils are near Brookside, Rigley, and Shelocta soils and are mixed on some landscapes with Rigley soils. They are not so deep as Brookside soils and have more sand in the upper part of the solum. Donahue soils are not so deep as Rigley and Shelocta soils, and they are more clayey in the lower part of the solum.

Donahue rocky sandy loam, 6 to 20 percent slopes (DoD).—This soil is on narrow to moderately wide ridgetops and side slopes. Rock outcrops cover 3 to 15 percent of the surface.

Included with this soil in mapping are small areas of Latham and Steinsburg soils and some areas of soils that are more rocky or less rocky than this Donahue soil. Also included is a soil that has a dark-brown surface layer.

The effective depth for root growth is about 31 inches.

This soil is not suited to cultivation, because it is rocky and is subject to a severe hazard of erosion. It is suited to pasture, trees, and wildlife habitat. Capability unit VIs-1; woodland suitability group 3x1; wildlife group 5.

Donahue rocky sandy loam, 20 to 40 percent slopes (DoF).—This soil is on side slopes. Rock outcrops cover from 5 to 25 percent of the surface.

Included with this soil in mapping are small areas of Brookside soils. Also included is a soil that has a dark-brown surface layer.

The effective depth for root growth is about 31 inches.

This soil is suited to trees and wildlife habitat. Because of rockiness and steepness, this soil is not suited to cultivation, and establishing and harvesting forage crops is very difficult. The hazard of erosion is very severe. Capability unit VIIs-1; woodland suitability group 3x1; wildlife group 5.

Gilpin Series

The Gilpin series consists of moderately deep, well-drained soils on uplands, mostly on ridgetops. These soils are very strongly acid. They formed in residuum derived from acid siltstone and shale. Slopes range from 6 to 20 percent.

In a representative profile in a wooded area the surface layer is dark-brown silt loam 2 inches thick. The subsoil is yellowish brown and is 30 inches thick. It is mainly heavy silt loam in the upper 8 inches, light silty clay loam in the middle 7 inches, and shaly silt loam in the lower 15 inches. Fractured bedrock is at a depth of about 32 inches.

The available water capacity is medium, and permeability is moderate. Natural fertility and organic-matter content are low.

Representative profile of Gilpin silt loam, 12 to 20 percent slope, about 1¼ miles west of Copperas Branch road from State Route 32, then 200 feet south on lower side slope, in Rowan County:

O11—1⅛ inches to ⅛ inch, hardwood leaves and twigs.
O12—⅛ inch to 0, partially decomposed leaves and twigs.
A1—0 to 2 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; very friable; 3 percent shale fragments; common roots; very strongly acid; abrupt, smooth boundary.
B1—2 to 5 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; 5 percent siltstone and shale fragments; common roots; very strongly acid; abrupt, smooth boundary.
B21t—5 to 10 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak to moderate, medium, subangular blocky structure; friable; distinct, patchy clay films on peds; 8 percent coarse fragments; few roots; very strongly acid; clear, wavy boundary.
B22t—10 to 17 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; prominent, discontinuous clay films on peds; 20 percent shale and siltstone fragments; few roots; very strongly acid; clear, smooth boundary.
B3t—17 to 32 inches, yellowish-brown (10YR 5/6) shaly silt loam; weak, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 25 percent shale and siltstone fragments; few roots; very strongly acid; gradual, wavy boundary.
R—32 inches +, strong-brown (7.5YR 5/6) and gray (10YR 6/1) fractured shale and siltstone.

Depth to shale or siltstone is 30 to 40 inches. The thickness of the solum ranges from 20 to 36 inches. Content of coarse fragments in the A1 and B1 horizons is less than 10 percent and in the B2t and B3t horizons is commonly 5 to 30 percent. The A1 horizon is dark brown (10YR 4/3 or 10YR 3/3) or very dark grayish brown (10YR 3/2). The Ap horizon, if present, is dark brown (10YR 4/3). The B1 and B2t horizons range from light olive brown (2.5Y 5/4) to yellowish brown (10YR 5/8), and the texture of the fine earth fraction is silt loam or silty clay loam. The B3 horizon ranges from strong brown (7.5 YR 5/6) to olive (5Y 5/3) and in some places is mottled in hues of red, brown, and gray. An olive-brown (2.5Y 4/4) or light olive-brown (2.5Y 5/4) C horizon that is largely weathered shale or siltstone is present in some places.

Gilpin soils are near Cranston and Whitley soils. They are not so deep as those soils. They contain more coarse fragments than Whitley soils.

Gilpin silt loam, 6 to 12 percent slopes (GlC).—This soil is on ridgetops. It has a profile similar to the one described as representative for the series, but the surface layer is slightly thicker. Included in mapping are small areas of Latham and Whitley soils.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is about 32 inches.

This soil is suited to most of the commonly grown cultivated crops. It is also suited to trees and to pasture or hay. Most areas are forested. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-5; woodland suitability group 3o1; wildlife group 1.

Gilpin silt loam, 12 to 20 percent slopes (GlD).—This soil is on ridgetops. It has the profile described as representative for the series. Included in mapping are small areas of Whitley and Cranston soils.

The response of crops to lime and fertilizer is good. The effective depth for root growth is about 32 inches.

This soil is suited to trees, hay, and pasture and to occasional cultivation. If it is cultivated, the hazard of erosion is very severe. Most areas are forested. Capability unit IVe-2; woodland suitability group 3o1; wildlife group 2.

Hartsells Series

The Hartsells series consists of moderately deep, well-drained soils on both broad and narrow ridgetops on uplands. These soils are very strongly acid. They formed in residuum derived from acid sandstone. Slopes range from 6 to 20 percent.

In a representative profile the surface layer is dark-brown and brown fine sandy loam about 7 inches thick. The subsoil is 19 inches thick. The upper 5 inches is yellowish-brown fine sandy loam, the next 8 inches is yellowish-brown sandy clay loam, and the lower 6 inches is strong-brown light clay loam. The substratum is strong-brown gravelly sandy loam. Bedrock is at a depth of about 36 inches.

The available water capacity is medium, and permeability is moderately rapid. Natural fertility and organic-matter content are low.

Representative profile of Hartsells fine sandy loam, 12 to 20 percent slopes, about 1 mile south on State Route 1378 from county line at North Fork Licking River, south about 200 yards on private road, in Morgan County:

O11—3½ inches to ½ inch, hardwood leaves and twigs and pine needles.

O12—½ inch to 0, partially decomposed leaves and needles.

A1—0 to 2 inches, dark-brown (10YR 3/3) fine sandy loam; weak, fine, granular structure; very friable; 1 percent sandstone fragments; common roots; very strongly acid; abrupt, smooth boundary.

A2—2 to 7 inches, brown (10YR 4/3) fine sandy loam; common, medium, distinct mottles of yellowish brown (10YR 5/6); weak, fine, granular structure to weak, fine, subangular blocky; friable; 1 percent sandstone fragments; common roots; very strongly acid; clear, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, subangular blocky structure; friable; 1 percent sandstone fragments; few roots; very strongly acid; clear, wavy boundary.

B2t—12 to 20 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak to moderate, fine and medium, subangular blocky structure; friable; distinct, patchy clay films on peds; 2 percent sandstone fragments; few roots; very strongly acid; clear, wavy boundary.

B3t—20 to 26 inches, strong-brown (7.5YR 5/6) light clay loam; weak, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 5 percent sandstone fragments; few roots; very strongly acid; clear, wavy boundary.

C—26 to 36 inches, strong-brown (7.5YR 5/6) gravelly sandy loam; weak, fine, subangular blocky structure to massive; friable; few mica flakes; 35 percent sandstone fragments; few roots; very strongly acid; abrupt, wavy boundary.

R—36 inches +, sandstone.

Depth to bedrock is 24 to 42 inches. The solum ranges from 20 to 35 inches in thickness. The A1 horizon is dark brown (10YR 3/3 or 10YR 4/3), and the A2 horizon ranges from brown (10YR 4/3) to grayish brown (10YR 5/2). The A horizon ranges from fine sandy loam to loam. The Bt horizon ranges from yellowish-brown (10YR 5/4) to strong-brown (7.5YR 5/6) loam, sandy clay loam, or light clay loam. The C horizon ranges from strong-brown (7.5YR 5/6) to brownish-yellow (10YR 6/6) gravelly sandy loam, sandy loam, or loamy sand.

These soils are 2 to 3 degrees cooler than is defined as within the range for the series, but this difference does not alter their usefulness and behavior.

Hartsell soils occur near Rigley, Monongahela, and Steinsburg soils. They are not so deep as Rigley soils. They are not so deep to bedrock as Monongahela soils and lack the fragipan of those soils. They have a B horizon of clay accumulation that Steinsburg soils lack.

Hartsells fine sandy loam, 6 to 12 percent slopes (HaC).—This soil is on ridgetops. Included in mapping are small areas of Latham, Gilpin, and Steinsburg soils.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is about 36 inches.

This soil is suited to trees, to most of the commonly grown cultivated crops, and to hay and pasture. Most areas are forested. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe–5; woodland suitability group 2o1; wildlife group 1.

Hartsells fine sandy loam, 12 to 20 percent slopes (HaD).—This soil is on narrow ridgetops. It has the profile described as representative for the series. Included in mapping are small areas of Steinsburg and Latham soils.

The response of crops to lime and fertilizer is good. The effective depth for root growth is about 36 inches.

This soil is suited to trees, hay, or pasture and also to occasional cultivation. Most areas are forested. Depth to sandstone limits the use of this soil for construction. If this soil is cultivated, the hazard of erosion is very severe. Capability unit IVe–2; woodland suitability group 2o1; wildlife group 2.

Johnsburg Series

The Johnsburg series consists of deep, somewhat poorly drained soils that have a fragipan. These soils are on second bottoms and ridgetops. They are very strongly acid, except that the surface layer is less acid where it has been limed. These soils formed in alluvium or residuum derived from acid siltstone and shale. Slopes range from 0 to 4 percent.

In a representative profile the surface layer is about 8 inches thick. It is brown silt loam that has light yellowish-brown mottles. The subsoil is 67 inches thick. The upper 7 inches is light yellowish-brown silt loam that has light brownish-gray and yellowish-brown mottles; the next 40 inches is a firm, compact fragipan layer, the upper part of which is light yellowish-brown silt loam that has light-gray, light olive-gray, and yellowish-brown mottles, and the lower part of which is light olive-gray silt loam that has light yellowish-brown, yellowish-brown, and very dark grayish-brown mottles; the next 15 inches is light-gray silt loam that has yellowish-brown mottles; and the lower 5 inches is yellowish-brown silt loam that has light-gray mottles. Bedrock is at a depth of 75 inches.

The available water capacity is medium, and permeability is very slow. Natural fertility and organic-matter content are low.

Representative profile of Johnsburg silt loam, on dirt road about 1¼ miles up Scott Creek from State Route 801 and about 30 yards left in pasture field, in Rowan County:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; few, coarse, distinct mottles of light yellowish brown (10YR 6/4); weak, medium, granular structure; very friable; many roots; slightly acid; clear, smooth boundary.

B1t—8 to 15 inches, light yellowish-brown (2.5Y 6/4) silt loam; few, fine, distinct mottles of light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6); weak, fine, subangular blocky structure; very friable; common cavities; faint, patchy clay films in cavities; many roots; common pores; very strongly acid; clear, wavy boundary.

Bx1t—15 to 29 inches, light yellowish-brown (2.5Y 6/4) silt loam; many, medium, prominent mottles of light gray (10YR 7/1), light olive gray (5Y 6/2), and yellowish brown (10YR 5/6); very coarse, prismatic structure parting to medium and coarse, angular blocky; firm, brittle and compact; common cavities; faint, patchy clay films in cavities; common pores; few black concretions; very strongly acid; clear, wavy boundary.

Bx2t—29 to 55 inches, light olive-gray (5Y 6/2) silt loam; many, coarse, prominent mottles of light yellowish brown (2.5Y 6/4), yellowish brown (10YR 5/6), and very dark grayish brown (10YR 3/2); very coarse, prismatic structure parting to medium and coarse, angular blocky; firm, brittle and compact; common cavities; 1 percent gravel; common pores; many black concretions; very strongly acid; gradual, wavy boundary.

B31g—55 to 70 inches, light-gray (5Y 7/1) silt loam; many, medium, prominent mottles of yellowish brown (10YR 5/8); weak, fine, subangular blocky structure to massive; friable; very strongly acid; gradual, wavy boundary.

B32—70 to 75 inches, yellowish-brown (10YR 5/6) silt loam; common, medium, prominent mottles of light gray (5Y 7/1); weak, fine, subangular blocky structure to massive; friable; very strongly acid; abrupt, smooth boundary.

R—75 inches +, siltstone bedrock.

Depth to shale or siltstone is 48 inches or more. The solum ranges from 45 to 70 inches in thickness. Depth from the surface to the fragipan is commonly about 15 inches but ranges from 15 to 25 inches. The fragipan ranges from 24 to 45 inches in thickness. Reaction is typically very strongly acid to extremely acid throughout in areas that are not limed. The Ap horizon is brown (10YR 5/3 or 10YR 4/3). The B1 horizon is light yellowish brown (2.5Y 6/4 or 10YR 6/4) or yellowish brown (10YR 5/6). The Bx and B3 horizons, both matrix and mottles, are shades of gray and brown in hues of 10YR to 5Y. The B horizon is silt loam or light silty clay loam.

These soils are yellower in hue and more gray in the Bx and B31g horizons than is defined as within the range for the series, but this difference does not affect their use and management.

Johnsburg soils are near Monongahela, Tilsit, and Mullins soils. They contain less sand and are more poorly drained than Monongahela soils. Johnsburg soils are more poorly drained than Tilsit soils and better drained than Mullins soils.

Johnsburg silt loam (0 to 4 percent slopes) (Jo).—This soil is on stream terraces and broad ridgetops. Included in mapping are small areas of Tilsit and Mullins soils.

This soil has a seasonal high water table at a depth of ½ to 1 foot. The effective depth for root growth is restricted by the fragipan at a depth of 15 to 25 inches. Tillage is often delayed by wetness. The response of crops to lime and fertilizer is good if adequate drainage is provided.

This soil is suited to water-tolerant crops, pasture, and hay. Trees and wildlife habitat are suitable uses of this soil. Most areas are cleared. If this soil is cultivated, the hazard of erosion is slight. Capability unit IIIw–2; woodland suitability group 2w1; wildlife group 7.

Latham Series

The Latham series consists of moderately deep, moderately well drained soils on narrow ridges, benches, and upper side slopes on uplands. These soils are very strongly acid. They formed in residuum derived from acid shale. Slopes range from 6 to 50 percent.

In a representative profile the surface layer is dark-brown silt loam about 6 inches thick. The subsoil is 19 inches thick. The upper 5 inches is yellowish-brown light silty clay loam, the next 9 inches is strong-brown silty clay, and the lower 5 inches is yellowish-brown silty clay that has light brownish-gray and strong-brown mottles. Below this, and extending to a depth of 36 inches, is a substratum of pale-brown silty clay that has light-gray and strong-brown mottles. Soft shale is at a depth of about 36 inches.

The available water capacity is medium, and permeability is slow. Natural fertility and organic-matter content are low.

Representative profile of Latham silt loam, 12 to 20 percent slopes, about 1¾ miles south of State Route 1378 from county line at the North Fork of the Licking River, then north about 60 yards from the road below a cemetery, in Morgan County:

Ap—0 to 6 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; 2 percent shale fragments; common roots; very strongly acid; clear, smooth boundary.

B1—6 to 11 inches, yellowish-brown (10YR 5/6) light silty clay loam; weak, fine, subangular blocky structure; friable; 2 percent shale fragments; common roots; very strongly acid; clear, wavy boundary.

B2t—11 to 20 inches, strong-brown (7.5YR 5/8) silty clay; moderate, fine and medium, subangular blocky structure; firm; distinct, discontinuous clay films; 4 percent shale fragments; few roots; very strongly acid; clear, wavy boundary.

B3t—20 to 25 inches, yellowish-brown (10YR 5/6) silty clay; common, medium, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; firm; distinct, patchy clay films; 4 percent shale fragments; few roots; very strongly acid; clear, wavy boundary.

C—25 to 36 inches, pale-brown (10YR 6/3) silty clay; many, medium, distinct mottles of light gray (10YR 6/1) and strong brown (7.5YR 5/6); weak, fine and medium, subangular blocky structure; firm; 4 percent shale fragments; few roots; very strongly acid; gradual, wavy boundary.

R—36 inches +, pale-brown (10YR 6/3) clay and soft shale; many, medium, distinct mottles of light gray (10YR 6/1) and strong brown (7.5YR 5/6); horizontally bedded; few roots; very strongly acid.

Depth to soft shale ranges from 30 to 40 inches. The solum ranges from 20 to 36 inches in thickness. Depth to gray mottles (2 or less in chroma) ranges from 12 to 20 inches. The Ap horizon is dark brown (10YR 4/3), yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), or dark grayish brown (10YR 4/2). The Bt horizon is strong brown (7.5YR 5/8 or 7.5YR 5/6) or yellowish brown (10YR 5/6) and has gray, brown, or red mottles. The texture is silty clay or clay. The C horizon ranges from light grayish brown (10YR 6/2) to yellowish brown (10YR 5/4) and has gray, brown, or red mottles. The texture is silty clay or clay. The R horizon can be dug into fairly easily in most places.

Latham soils occur near Shelocta, Gilpin, Whitley, and Tilsit soils. They are more clayey in the B horizon than those soils. They are better drained than Tilsit soils and lack the fragipan of Tilsit soils.

Latham silt loam, 6 to 12 percent slopes (LaC).—This soil is on ridgetops. Included in mapping are small areas of Gilpin soils and small areas of Latham soils that are severely eroded.

The effective depth for root growth is about 36 inches.

This soil is suited to most of the commonly grown cultivated crops and to hay and pasture. It is also suited to trees and wildlife habitat. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe–2; woodland suitability group 3c1; wildlife group 1.

Latham silt loam, 12 to 20 percent slopes (LaD).—This soil is on narrow ridgetops, benches, and upper side slopes. It has the profile described as representative for the series. Included in mapping are small areas of Hartsells and Shelocta soils. Also included is a small acreage of severely eroded soils.

The effective depth for root growth is about 36 inches.

This soil is suited to hay and pasture and to trees and wildlife habitat. It can be cultivated occasionally. If this soil is cultivated, the hazard of erosion is very severe. Capability unit IVe–3; woodland suitability group 3c1; wildlife group 2.

Latham silt loam, 20 to 30 percent slopes (LaE).—This soil is on side slopes, noses, and ridges. Included in

mapping are small areas of Shelocta, Brookside, and Gilpin soils.

The effective depth for root growth is about 36 inches.

This soil is suited to pasture, trees, and wildlife habitat. Harvesting hay is difficult because of steepness. The hazard of erosion is too severe for growing cultivated crops. Capability unit VIe–2; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Latham-Shelocta silt loams, 12 to 20 percent slopes (LsD).—This complex is on ridgetops, on side slopes, and at the head of drainageways. The moderately deep Latham soils, which make up about 55 percent of the complex, are on convex noses and upper side slopes. The deep Shelocta soils, which make up about 35 percent, are on smooth, lower side slopes and in coves. These soils formed in residuum and colluvium derived from acid shale and siltstone. The soils are so closely intermingled that mapping them separately was considered impractical.

Included with this complex in mapping are small areas of Gilpin and Rigley soils. Stones cover as much as 2 percent of the surface in a few areas.

These soils are suited to pasture and hay and to trees and wildlife habitat. They are also suited to occasional cultivation. If these soils are cultivated. the hazard of erosion is very severe. Capability unit IVe–3; woodland suitability group 3c1; wildlife group 2.

Latham-Shelocta silt loams, 20 to 30 percent slopes (LsE).—This complex is on side slopes. The moderately deep Latham soils, which make up about 55 percent of the complex, are on convex noses and upper side slopes. The deep Shelocta soils, which make up about 35 percent, are on smooth, lower side slopes and in coves. These soils formed in residuum or colluvium derived from acid shale and siltstone. These soils are so closely intermingled that mapping them separately was considered impractical. A soil in this complex has the profile described as representative for the Shelocta series.

Included with this complex in mapping are small areas of Rigley and Gilpin soils. Stones cover 2 percent or more of the surface in some small areas, and in places the surface is cobbly.

These soils are suited to pasture or to trees and wildlife habitat. Most areas are wooded. Because of the very severe hazard of erosion, these soils are not suited to cultivation. Capability unit VIe–2; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Latham-Shelocta silt loams, 30 to 50 percent slopes (LsF).—These soils are on side slopes. The moderately deep Latham soils, which make up about 60 percent of this complex, are on convex noses and upper side slopes. The deep Shelocta soils, which comprise about 35 percent, are on smooth, lower side slopes and in coves. These soils formed in residuum and colluvium derived from acid shale and siltstone. The soils are so closely intermingled that mapping them separately was considered impractical.

Included with this complex in mapping are small areas of Rigley and Gilpin soils. Stones cover 2 percent or more of the surface in some small areas, and in some small areas the surface is cobbly.

These soils are suited to trees and wildlife habitat. Most areas are wooded. Because of the very severe hazard of erosion, these soils are not suited to cultivation and have very limited suitability for pasture. Capability unit VIIe–1; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Monongahela Series

The Monongahela series consists of deep, moderately well drained soils that have a fragipan. These soils are on old, high stream terraces along the larger streams. They are very strongly acid or strongly acid except where limed. They formed in alluvium from soils derived from acid sandstone, siltstone, and shale. Slopes range from 2 to 6 percent.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 8 inches thick. The subsoil is 40 inches thick. The upper 13 inches is yellowish-brown loam and sandy clay loam, and the lower 27 inches is a firm, compacted fragipan layer. The upper part of this fragipan is yellowish-brown sandy clay loam that has light-gray and strong-brown mottles, and the lower part is pale-brown loam that has strong-brown and light-gray mottles. The substratum extends to a depth of 84 inches. The upper 17 inches is light yellowish-brown light clay loam that has light-gray, yellowish-brown, and strong-brown mottles; and the lower 19 inches is pale-olive light clay loam that has light-gray and yellowish-brown mottles.

The available water capacity is medium, and permeability is slow. Natural fertility and organic-matter content are low.

Representative profile of Monongahela fine sandy loam, 2 to 6 percent slopes, 5½ miles south of Farmers, on State Route 801, 300 yards south of road, in Rowan County:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable; common roots; slightly acid; clear, smooth boundary.

B1t—8 to 14 inches, yellowish-brown (10YR 5/4) loam; weak, fine, subangular blocky structure; friable; faint, patchy clay films on peds; common roots; common pores; strongly acid; clear, wavy boundary.

B2t—14 to 21 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, fine and medium, subangular blocky structure; friable; faint, patchy clay films on peds; few roots; few manganese featherings of very dark gray (10YR 3/1); strongly acid; clear, wavy boundary.

Bx1t—21 to 30 inches, yellowish-brown (10YR 5/4) sandy clay loam; many, medium, distinct mottles of light gray (10YR 7/1) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; firm; distinct, patchy clay films on peds; few roots; very strongly acid; gradual, wavy boundary.

Bx2t—30 to 48 inches, pale-brown (10YR 6/3) loam; many medium, distinct, mottles of strong brown (7.5YR 5/6) and light gray (N 7/0); weak, fine and medium, subangular blocky structure; firm and brittle; faint, patchy clay films on peds and in cavities; very strongly acid; gradual, wavy boundary.

C1—48 to 65 inches, light yellowish-brown (2.5Y 6/4) light clay loam; many, coarse, distinct mottles of light gray (2.5Y 7/2), yellowish brown (10YR 5/8), and strong brown (7.5YR 5/6); weak, fine, subangular blocky structure; friable to firm; distinct, patchy clay films on peds; very strongly acid; gradual, wavy boundary.

C2—65 to 84 inches +, pale-olive (5Y 6/3) light clay loam; many, coarse, distinct mottles of light gray (2.5Y 7/2) and yellowish brown (10YR 5/6); massive; firm; very strongly acid.

Depth to shale or siltstone is 72 inches or more. The solum ranges from 40 to 60 inches in thickness. The depth to the fragipan ranges from 20 to 26 inches, and the fragipan ranges from 20 to 38 inches in thickness. The reaction is strongly acid or very strongly acid throughout the profile, but the A horizon is less acid where it has been limed. The B1t and B2t horizons are yellowish brown (10YR 5/4 or 10YR 5/6) or light yellowish brown (10YR 6/4) and range from sandy clay loam to light silty clay loam. The Bxt horizon ranges from pale-brown (10YR 6/3) to yellowish-brown (10YR 5/4) sandy clay loam, loam, or light clay loam. The C horizon ranges from pale olive (5Y 6/3) to yellowish brown (10YR 5/6) and is mottled with gray and brown. The texture is light clay loam, loam, sandy clay loam, or sandy loam.

Monongahela soils are near Tilsit, Johnsburg, and Mullins soils. They contain more sand than Tilsit soils. They contain more sand and are better drained than Johnsburg and Mullins soils.

Monongahela fine sandy loam, 2 to 6 percent slopes (MoB).—This soil is on high stream terraces. Included in mapping are small areas of Johnsburg and Allegheny soils.

This soil has a seasonal high water table at a depth of 1½ to 2 feet. The soil is easily tilled, and the response of crops to lime and fertilizer is good. The effective depth for root growth is restricted by the fragipan.

This soil is suited to trees, hay, pasture, and most cultivated crops, except plants that do not grow well if root growth is very restricted below a depth of 20 to 26 inches. Most areas are cleared. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe–2; woodland suitability group 3o1; wildlife group 1.

Morehead Series

The Morehead series consists of deep, somewhat poorly drained to moderately well drained soils on second bottoms. These soils are strongly acid or very strongly acid, but the surface layer is less acid where it has been limed. They formed in alluvium washed from soils derived from acid siltstone and shale. Slopes range from 0 to 4 percent.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 48 inches, is yellowish-brown silt loam that has light yellowish-brown, light brownish-gray, and strong-brown mottles. The underlying material, which extends to a depth of 70 inches, is pale-brown silt loam that has strong-brown, very dark grayish-brown, and light-gray mottles.

The available water capacity is high, and permeability is moderate. Natural fertility is medium, and organic-matter content is low.

Representative profile of Morehead silt loam, about 1¾ miles northwest of Cranston, on the Clear Fork Road, 50 yards northeast of an old abandoned barn, in Rowan County:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; few roots; medium acid; clear, smooth boundary.

B1—8 to 18 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, faint mottles of light yellowish brown (10YR 6/4) and few, fine, distinct mottles of light brownish gray (10YR 6/2); weak, fine and medium, subangular blocky structure; friable; few roots; very strongly acid; gradual, wavy boundary.

B21t—18 to 30 inches, yellowish-brown (10YR 5/6) silt loam, many, medium, faint mottles of strong brown (7.5YR 5/6) and common, fine, distinct mottles of light brownish gray (10YR 6/2); weak, fine and medium, subangular blocky structure; friable; few fine and very fine pores; distinct, patchy clay films on peds and faint, patchy clay films in pores; few fine and very fine concretions; very strongly acid; gradual, wavy boundary.

B22t—30 to 38 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, faint mottles of strong brown (7.5YR 5/6) and common, fine, distinct mottles of light brownish gray (10YR 6/2); weak, fine and medium, subangular blocky structure; friable; few fine and very fine pores; thin, discontinuous clay films on peds and along pores; very strongly acid; gradual wavy boundary.

B3t—38 to 48 inches, light yellowish-brown (10YR 6/4) silt loam, many, medium, faint mottles of strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2); weak, fine, subangular blocky structure; friable; few fine and very fine pores; thin, discontinuous clay films in cavities; very strongly acid; gradual, wavy boundary.

C—48 to 70 inches +, pale-brown (10YR 6/3) silt loam; many, fine, distinct mottles of strong brown (7.5YR 5/6), very dark grayish brown (10YR 3/2), and light gray (10YR 7/1); massive; firm; very strongly acid.

Depth to shale or siltstone bedrock is 72 inches or more. The solum ranges from 40 to 52 inches in thickness. Reaction is very strongly acid or strongly acid in all horizons, except in the surface layer where lime has been added. The B1 and B2t horizons are yellowish brown (10YR 5/6 or 10YR 5/4), strong brown (7.5YR 5/6), or light olive brown (2.5Y 5/4) and have mottles of gray or brown. Depth to mottles that are 2 or less in chroma ranges from 8 to 24 inches but is generally 8 to 14 inches. The Bt horizon is silt loam or light silty clay loam. The matrix of the B3t and C horizons ranges from yellowish brown (10YR 5/6) to pale brown (10YR 6/3). The C horizon is silt loam, loam, or light silty clay loam and is stratified in some places.

Morehead soils occur near Cotaco, Whitley, and Johnsburg soils. They have less sand in the B horizon than Cotaco soils. They are less well drained than Whitley soils. They lack the fragipan of Johnsburg soils.

Morehead silt loam (0 to 4 percent slopes) (Mp).—This soil is on low stream terraces. Included in mapping are small areas of Bonnie and Whitley soils. Also included are some permanently wet spots.

This soil has a seasonal high water table at a depth of 1 to 2 feet. If adequately drained, this soil is easily tilled and the response of crops to lime and fertilizer is good. The effective depth for root growth is restricted by the high water table, mostly late in winter and in spring.

This soil is better suited to plants that tolerate wetness than to other plants. If adequate drainage is provided, this soil is suited to all of the commonly grown crops and pasture and hay plants except alfalfa. The soil is well suited to trees and wildlife habitat. If this soil is cultivated, the hazard of erosion is none to slight. Some areas are subject to occasional flooding. Capability unit IIw–2; woodland suitability group 2w1; wildlife group 7.

Mullins Series

The Mullins series consists of deep, poorly drained soils that have a fragipan. These soils are on high stream terraces and broad ridgetops. These soils are strongly acid or very strongly acid in the surface layer. They

formed in alluvium or residuum derived from siltstone and shale. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is about 9 inches thick. It is light brownish-gray silt loam that has yellowish-brown mottles. The subsoil is 39 inches thick. The upper 7 inches is gray heavy silt loam that has strong-brown mottles, and the lower 32 inches is a firm, compact fragipan that is mottled gray and yellowish-brown light silty clay loam. The substratum extends to a depth of 60 inches. It is mottled gray and strong-brown silty clay loam.

The available water capacity is medium, and permeability is very slow. Natural fertility and organic-matter content are low.

Representative profile of Mullins silt loam, near Farmers, about 1 mile north of U.S. Highway 60 on State Route 801, then west on State Route 1722 for about 3¼ miles, then southwest 150 yards in a field, in Rowan County:

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) silt loam; few, fine, faint mottles of yellowish brown (10YR 5/4); weak, fine, granular structure; very friable; few roots; strongly acid; clear, smooth boundary.

B2tg—9 to 16 inches, gray (5Y 5/1) heavy silt loam; common, medium, prominent mottles of strong brown (7.5YR 5/6); weak, fine and medium, subangular blocky structure; friable; few roots; common thin clay films; very strongly acid; gradual, wavy boundary.

Bx1—16 to 28 inches, gray (5Y 6/1) light silty clay loam; many, medium, prominent mottles of yellowish brown (10YR 5/8); moderate, very coarse and coarse, prismatic structure parting to weak, fine and medium, subangular blocky; firm, compact and brittle; common thin clay films; few, small, black concretions; very strongly acid; gradual, wavy boundary.

Bx2—28 to 48 inches, gray (5Y 6/1) light silty clay loam; common, medium, prominent mottles of yellowish brown (10YR 5/8); moderate, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm, compact and brittle; nearly continuous clay films; few, small, black concretions; very strongly acid; gradual, wavy boundary.

C—48 to 60 inches +, mottled gray (N 6/0) and strong-brown (7.5YR 5/6) silty clay loam; massive; firm, slightly sticky; common, small, black concretions; very strongly acid.

Depth to bedrock is 48 inches or more. The solum ranges from 35 to 55 inches in thickness. Depth to the fragipan ranges from 15 to 24 inches and averages about 16 inches. The Ap horizon is light brownish gray (10YR 6/2), grayish brown (10YR 5/2), or gray (5Y 5/1). The B horizon ranges from gray (5Y 5/1) to light gray (10YR 7/1) and includes neutral colors that are 5 to 7 in value. Mottles are in shades of brown. The B horizon is light silty clay loam or silt loam. The C horizon has the same color range as the B horizon, and its texture is silty clay loam, silt loam, loam, or clay loam.

Mullins soils occur near Tilsit and Johnsburg soils. They are more poorly drained than those soils.

Mullins silt loam (0 to 2 percent slopes) (Mr).—This soil is on stream terraces and broad ridges. Included in mapping are small permanent wet spots and small areas of Johnsburg soils.

This soil has a seasonal high water table above a depth of 6 inches. If this soil is drained, it is easily tilled and response of crops to lime and fertilizer is good. Drainage is difficult, however, because of shallowness to the fragipan and because of the lack of suitable areas for outlets. The effective depth for root growth is restricted to about 16 inches by wetness and the fragipan.

Water-tolerant trees and grasses are suited to this soil. Cultivation is hindered by wetness in spring and by the shallow rooting depth. During rainy periods, water collects in low places. Most areas of this soil are cleared. If this soil is cultivated, the hazard of erosion is none to slight. Capability unit IVw-1; woodland suitability group 1w1; wildlife group 6.

Muse Series

The Muse series consists of deep, well-drained soils on fans, toe slopes, and side slopes. These soils are strongly acid in the surface layer. They formed in colluvium washed from soils derived from acid black shale. Slopes range from 2 to 60 percent.

In a representative profile the surface layer is dark-brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. The upper 6 inches is strong-brown heavy silty loam, and the lower 34 inches is yellowish-red silty clay that has light brownish-gray mottles in the lower part. The underlying material, which extends to a depth of 62 inches, is red clay that has weak-red and light-gray mottles. Black shale is at a depth of 62 inches.

The available water capacity is high, and permeability is moderately slow. Natural fertility and organic-matter content are low.

Representative profile of Muse silt loam, 20 to 30 percent slopes, about 1 mile north of Farmers, on State Route 801, 2½ miles west on State Route 1722, ¾ mile south on dirt road around Green Mountain and 10 feet north of road, in Rowan County:

O11—1½ inches to ½ inch, hardwood leaves and twigs.

O12—½ inch to 0, partially decomposed leaves and twigs.

Ap—0 to 5 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine and medium, granular structure; friable; common roots; strongly acid; clear, wavy boundary.

B1t—5 to 11 inches, strong-brown (7.5YR 5/6) heavy silty clay loam; weak, fine, angular blocky structure; friable; faint, patchy clay films on peds; few roots; very strongly acid; gradual, wavy boundary.

B21t—11 to 24 inches, yellowish-red (5YR 4/6) silty clay; strong, fine and medium, angular blocky structure; friable; prominent patchy clay films on peds; few roots; very strongly acid; gradual, wavy boundary.

B22t—24 to 30 inches, yellowish-red (5YR 4/6) silty clay; strong, fine and medium, angular blocky structure; friable; distinct, continuous clay films on peds; few roots; very strongly acid; gradual, wavy boundary.

B3t—30 to 40 inches, yellowish-red (5YR 5/8) silty clay; few, fine, faint mottles of light brownish gray (10YR 6/2); strong, fine and medium, angular blocky structure; firm; distinct, continuous clay films on peds; few roots; very strongly acid; gradual, wavy boundary.

C—40 to 62 inches, red (2.5YR 4/6) clay; common, fine, distinct mottles of weak red (2.5YR 5/2) and light gray (10YR 7/1); massive; firm; distinct, continuous clay films on peds; very strongly acid.

R—62 inches +, brittle, black shale.

Depth to black shale bedrock is 60 inches or more. The solum ranges from 40 to 60 inches in thickness. The B1t and B2t horizons range from strong brown (7.5YR 5/6) to reddish brown (5YR 4/4). The B1t horizon is silty clay loam or light silty clay, and the B2t horizon ranges from heavy silty clay loam to clay. The B3 horizon ranges from yellowish-brown (10YR 5/4) to yellowish-red (5YR 5/8) silty clay or clay. The C horizon ranges from yellowish brown (10YR 5/4) to red (2.5YR 4/8). The B3 and C horizons comonly have mottles in shades of gray and brown. The C horizon is clay or silty clay.

Muse soils occur near Berks and Trappist soils. They are more clayey in the B and C horizons than Berks soils. They are deeper than Trappist soils.

Muse silt loam, 2 to 6 percent slopes (MsB).—This soil is on toe slopes and alluvial fans. It has a profile similar to the one described as representative for the series, but the surface layer is thicker. Included in mapping are small areas of Morehead soils and some areas of a soil that has a gravelly surface layer.

The response of crops to lime and fertilizer is good. This soil is easy to till. The effective depth for root growth is about 48 inches.

This soil is well suited to trees. It is also well suited to most of the commonly grown cultivated crops, hay, and pasture. Most areas are cleared. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe–1; woodland suitability group 3c1; wildlife group 1.

Muse silt loam, 6 to 12 percent slopes (MsC).—This soil is on toe slopes and alluvial fans. Included in mapping are small areas of Shelocta soils and areas of a soil that has a gravelly surface layer.

The response of crops to lime and fertilizer is good. The soil is somewhat difficult to till, because of the clay content. The effective depth for root growth is about 48 inches.

This soil is suited to trees, to most of the commonly grown cultivated crops, and to hay and pasture. Most areas are used for hay and pasture. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe–1; woodland suitability group 3c1; wildlife group 1.

Muse silt loam, 12 to 20 percent slopes (MsD).—This soil is on toe slopes. Included in mapping are small areas of Shelocta and Donahue soils and some areas of eroded soils.

The effective depth for root growth is 48 inches or more.

This soil is suited to pasture, hay, and occasional cultivation. Trees and wildlife habitat are also suitable uses. If this soil is cultivated, the hazard of erosion is very severe. Capability unit IVe–1; woodland suitability group 3c1; wildlife group 2.

Muse silt loam, 20 to 30 percent slopes (MsE).—This soil is on lower side slopes and toe slopes It has the profile described as representative for the series. Included in mapping are small areas of Donahue soils.

The effective depth for root growth is 48 inches or more.

This soil is suited to pasture, trees, and wildlife habitat. Steepness makes harvesting hay difficult. This soil is not suited to cultivation, because slopes are too steep and the hazard of erosion is too great. Capability unit VIe–2; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Muse-Trappist stony silt loams, 30 to 60 percent slopes (MtF).—This complex is on side slopes. The deep Muse soils, which make up about 55 percent of the complex, are on benchy to concave lower side slopes. The moderately deep Trappist soils, which make up about 40 percent, are on convex points and upper side slopes. This complex is commonly below siltstone outcrops. Stones cover 2 to 10 percent of the surface. These soils formed in colluvium or residuum derived from black acid shale. They are so intermingled that it was not considered practical to separate them in mapping. A soil in this complex has the profile described as representative of the Trappist series.

Included with this complex in mapping are small areas of Berks soils and some small areas of very steep, severely eroded soils on convex points.

The soils in this complex are suited to trees and wildlife habitat. Most areas are forested. Because of the hazard of erosion, steepness, and stoniness, the soils in this complex are very severely limited for most uses. Capability unit VIIs–1; woodland suitability group 2c2 on north-facing slopes and 3c2 on south-facing slopes; wildlife group 3.

Pope Series

The Pope series consists of deep, well-drained soils on flood plains. These soils are very strongly acid. They formed in alluvium washed from soils derived from sandstone and siltstone. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The subsoil, which extends to a depth of about 42 inches, is dark yellowish-brown fine sandy loam that has brownish-yellow mottles in the upper part. The substratum, which reaches a depth of 85 inches, is dark yellowish-brown fine sandy loam and a few thin layers of sandy loam and loamy sand.

Permeability is moderately rapid. Natural fertility and organic-matter content are medium.

Representative profile of Pope fine sandy loam, 0.4 mile east of the hamlet of Craney, 50 feet west of Craney Creek, 1/4 mile northeast of its confluence with the North Fork of the Licking River, in Rowan County:

Ap—0 to 8 inches, brown (10YR 4/3) fine sandy loam; moderate, medium, granular structure; very friable; many fine roots; very strongly acid; clear, smooth boundary.

B21—8 to 26 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; few faint mottles of brownish yellow (10YR 6/6); weak, medium, subangular blocky structure; very friable; common fine roots; few fine pores; very strongly acid; gradual, wavy boundary.

B22—26 to 42 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, fine and medium, subangular blocky structure; very friable; few very fine roots; few fine pores; very strongly acid; gradual, wavy boundary.

C—42 to 85 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; single grain; loose; few thin layers of sandy loam and loamy sand; very strongly acid.

Depth to underlying bedrock is 48 inches or more. The solum ranges from 30 to 48 inches in thickness. In most places, the profile is less than 10 percent gravel, but in some places there are layers in the solum that are as much as 30 percent and in the C horizon that are as much as 40 percent. The Ap horizon is brown (10YR 4/3), dark yellowish-brown (10YR 4/4), or dark grayish-brown (10YR 4/2) fine sandy loam, sandy loam, gravelly sandy loam, or gravelly fine sandy loam. The B horizon is dark yellowish brown (10YR 4/4), dark brown (10YR 4/3), or yellowish brown (10YR 5/6 or 10YR 5/4). The B horizon is fine sandy loam, loam, sandy loam, or gravelly sandy loam. Color and texture of the C horizon are the same as those of the B horizon, but the C horizon is stratified in some places.

Pope soils occur near Chavies, Rigley, Cranston, Renox, and Stendal soils. Pope soils lack the clay accumulation in the B horizon of Chavies and Rigley soils. They contain more sand in the B horizon than Cranston and Renox soils. They are better drained than Stendal soils.

Pope fine sandy loam (0 to 2 percent slopes) (Po).—This soil is on first bottoms of flood plains. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Stendal and Chavies soils. Also included are soils that have a dark-brown surface layer.

This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is more than 48 inches. The available water capacity is high.

This soil is well suited to most of the commonly grown cultivated crops and to hay and pasture. It is also well suited to trees and wildlife habitat. Most areas are cleared. If this soil is cultivated, the hazard of erosion is none to slight. This soil is subject to occasional flooding, generally in winter or in spring. Capability unit I-1; woodland suitability group 1o1; wildlife group 8.

Pope gravelly fine sandy loam (0 to 2 percent slopes) (Pp).—This soil is on first bottoms of flood plains. It has a profile similar to the one described as representative for the series, but gravel content ranges from 20 to 30 percent in the plow layer and subsoil and from 30 to 40 percent in the substratum.

Included with this soil in mapping are small areas of Chavies and Stendal soils. Also included are small areas of soils in which gravel content throughout the profile is 50 percent or more.

This soil is somewhat difficult to till, because the surface layer contains gravel. Response of crops to lime and fertilizer is good. The effective depth for root growth is about 40 inches. The available water capacity is medium.

This soil tends to be droughty, but with good management most of the common cultivated crops can be grown, as can hay or pasture. This soil is also suited to trees and wildlife habitat. Since this soil is subject to occasional flooding during winter and spring, fall-seeded crops can be damaged. The hazard of erosion is none to slight. Capability unit I-1; woodland suitability group 1o1; wildlife group 8.

Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained soils on rolling ridgetops and steep side slopes on uplands. These soils are very strongly acid. They formed in residuum derived from acid sandstone. Ramsey soils are mapped only in complexes with Steinsburg soils. Slopes range from 6 to 40 percent.

In a representative profile the surface layer is dark grayish-brown sandy loam about 2 inches thick. The subsurface layer is dark yellowish-brown sandy loam 5 inches thick. The subsoil is yellowish-brown sandy loam 7 inches thick. Bedrock is at a depth of 14 inches.

The available water capacity is very low, and permeability is rapid. Natural fertility and organic-matter content are low.

Representative profile of Ramsey sandy loam in an area of Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes, about 1/4 mile north of the confluence of Craney Creek and the North Fork of the Licking River, in Rowan County:

O11—3½ to 2 inches, leaves and twigs.

O12—2 inches to 0, partially decomposed leaves and twigs.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) sandy loam; moderate, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

A2—2 to 7 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, medium, granular structure; very friable; 3 percent gravel; common roots; very strongly acid; gradual, wavy boundary.

B—7 to 14 inches, yellowish-brown (10YR 5/6) sandy loam; weak, medium, granular to fine, subangular blocky structure; very friable, 8 percent gravel; a few roots; very strongly acid; abrupt, irregular boundary.

R—14 inches, sandstone.

Depth to sandstone bedrock is typically about 14 inches but ranges from 12 to 18 inches. The solum ranges from 12 to 18 inches in thickness. Content of coarse fragments in the solum ranges from 2 to 25 percent, and it generally increases with depth. The A1 horizon is dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or brown (10YR 4/3). The A2 horizon is dark yellowish brown (10YR 4/4), light yellowish brown (10YR 6/4), or yellowish brown (10YR 5/4). The B horizon is yellowish brown (10YR 5/6), brownish yellow (10YR 6/6), or strong brown (7.5YR 5/6). The A and B horizons are sandy loam or fine sandy loam. In some areas the C horizon is sand or loamy sand and is similar to the B horizon in color.

Ramsey soils are near Steinsburg, Hartsells, and Latham soils. They are more shallow than Steinsburg soils. They lack the B horizon of clay accumulation of Hartsells and Latham soils. They also have less clay in the B horizon than Latham soils.

Renox Series

The Renox series consists of deep, well-drained soils on foot slopes and fans. These soils are neutral. They formed in alluvium and colluvium washed from soils derived from sandstone, siltstone, limestone, and shale. Slopes range from 2 to 15 percent.

In a representative profile the surface layer is very dark grayish-brown gravelly fine sandy loam about 8 inches thick. The subsoil is 46 inches thick. The upper 6 inches is dark yellowish-brown gravelly loam, the next 24 inches is strong-brown light gravelly clay loam, and the lower 16 inches is dark-brown heavy gravelly loam. The substratum is dark yellowish-brown gravelly loam that extends to a depth of about 65 inches.

The available water capacity is high, and permeability is moderate. Natural fertility and organic-matter content are high.

Representative profile of Renox gravelly fine sandy loam, 2 to 6 percent slopes, 4½ miles east of Frenchburg on the east side of Beaver Creek, 600 yards southeast of Bashford Cemetery, in Menifee County:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly fine sandy loam; weak, fine and medium, granular structure; very friable; common roots; 15 percent gravel; neutral; abrupt, smooth boundary.

B1—8 to 14 inches, dark yellowish-brown (10YR 4/4) gravelly loam; weak, fine and medium, subangular blocky structure; very friable; common fine roots; 15 percent gravel; neutral; clear, smooth boundary.

B2t—14 to 38 inches, strong-brown (7.5YR 5/6) light gravelly clay loam; moderate, fine and medium, subangular blocky structure; friable; few fine roots; many, thin, dark-brown clay films; 15 percent gravel; neutral; gradual, smooth boundary.

B3t—38 to 54 inches, dark-brown (7.5YR 4/4) heavy gravelly loam; weak, medium, subangular blocky structure; friable; common thin clay films on peds; 20 percent gravel; neutral; gradual, wavy boundary.

C—54 to 65 inches +, dark yellowish-brown (10YR 4/4) gravelly loam; massive; friable; 25 percent gravel; neutral.

Depth to siltstone is 60 inches or more. The solum ranges from 40 to 60 inches in thickness. Content of coarse fragments ranges from 5 to 30 percent in any horizon, and it

generally increases with depth. The Ap horizon is very dark grayish-brown (10YR 3/2) or dark-brown (10YR 3/3) gravelly loam, gravelly silt loam, silt loam, or loam. The B and C horizons are brown (7.5YR 4/4 or 10 YR 4/3), dark yellowish brown (10YR 4/4), or strong brown (7.5YR 5/6). The B and C horizons are loam, clay loam, silt loam, silty clay loam, or sandy clay loam and their gravelly analogs.

Renox soils are near Cotaco, Skidmore, Rigley, and Brookside soils. They are better drained than Cotaco soils. They have a B horizon of clay accumulation that Skidmore soils lack. They contain more clay in the B horizon and are less acid throughout than Rigley soils. They have less clay in the B horizon than Brookside soils.

Renox gravelly fine sandy loam, 2 to 6 percent slopes (ReB).—This soil is on alluvial fans. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Rigley and Skidmore soils. Also included are small areas that are not gravelly.

This soil is somewhat difficult to till because the surface layer contains gravel. The effective depth for root growth is more than 48 inches.

This soil is well suited to all of the commonly grown cultivated crops, hay, and pasture. It is also suited to trees and wildlife habitat. Most areas of this soil are cleared. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe-3; woodland suitability group 2o1; wildlife group 1.

Renox gravelly fine sandy loam, 6 to 15 percent slopes (ReC).—This soil is on alluvial fans and toe slopes. Included in mapping are small areas of a soil that is similar to this Renox soil but steeper.

This soil is somewhat difficult to till, because the surface layer contains gravel. The effective depth for root growth is 48 inches or more.

This soil is well suited to trees and to most of the commonly grown cultivated crops. It is also well suited to hay and pasture. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-4; woodland suitability group 2o1; wildlife group 1.

Rigley Series

The Rigley series consists of deep, well-drained soils on side slopes, toe slopes, and fans. These soil are very strongly acid. They formed in alluvium and colluvium washed from soils derived from sandstone, siltstone, and shale. Slopes range from 2 to 60 percent.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 5 inches thick. The subsoil is 40 inches thick. The upper 4 inches is dark yellowish-brown fine sandy loam, the next 30 inches is brown gravelly sandy loam, and the lower 6 inches is yellowish-brown gravelly sandy loam. The substratum, which extends to a depth of 55 inches or more, is yellowish-brown gravelly sandy loam.

The available water capacity is high, and permeability is moderately rapid. Natural fertility is medium, and organic-matter content is low.

Representative profile of Rigley stony fine sandy loam, 30 to 60 percent slopes, about 10 miles east of Morehead on east-facing side slope along Craney Creek, 1½ miles north of its confluence with Wagner Fork, 3 miles south of Elliottville in Rowan County:

O1—½ inch to 0, partly decomposed leaf litter.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, medium, granular structure; very friable; many fine roots; 10 percent sandstone gravel and stones; very strongly acid; clear, smooth boundary.

B1—5 to 9 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, fine, subangular blocky structure; very friable; many fine roots; 10 percent sandstone fragments and a few small quartzite pebbles; very strongly acid; clear, smooth boundary.

B21t—9 to 15 inches, brown (7.5YR 4/4) gravelly sandy loam; weak, coarse, subangular blocky structure parting to weak, fine and medium, subangular blocky; very friable; common fine roots; 15 percent sandstone fragments; common thin clay films; very strongly acid; gradual, smooth boundary.

B22t—15 to 39 inches, brown (7.5YR 4/4) gravelly sandy loam; moderate, coarse, subangular blocky structure parting to weak, fine and medium, subangular blocky; friable; few fine roots; thin, nearly continuous clay films; 20 percent sandstone fragments; very strongly acid; gradual smooth boundary.

B3t—39 to 45 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; few, fine, faint mottles of strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable; common thin clay films; few, small, black concretions; 20 percent sandstone fragments; very strongly acid; gradual, smooth boundary.

C—45 to 55 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; common, medium, faint mottles of light brownish-gray (10YR 6/2); massive; friable; 25 percent sandstone fragments; few, small, black concretions; very strongly acid.

About 10 percent of the surface is covered by stones. Depth to shale, sandstone, or siltstone is 60 inches or more. The solum ranges from 42 to 55 inches in thickness. It is 5 to 35 percent coarse fragments. The A1 horizon is dark grayish brown (10YR 4/2), dark yellowish brown (10YR 3/4), dark brown (10YR 4/3), or olive brown (2.5Y 4/4). The A horizon is stony fine sandy loam, stony sandy loam, or stony loam. The B and C horizons range from brown (7.5YR 4/4) to yellowish brown (10YR 5/8). The texture of the fine earth fraction of the B horizon is sandy loam, fine sandy loam, or loam. The texture of the fine earth fraction of the C horizon ranges from sandy loam to clay loam.

Rigley soils are near Shelocta, Donahue, Latham, and Steinsburg soils. They contain more sand throughout than Shelocta soils. They are deeper and less clayey in the B horizon than Donahue and Latham soils. Rigley soils are deeper than Steinsburg soils and have a B horizon of clay accumulation, which Steinsburg soils lack.

Rigley gravelly fine sandy loam, 2 to 6 percent slopes (RgB).—This soil is on toe slopes and alluvial fans. Included in mapping are small areas of Pope and Allegheny soils.

This soil is somewhat difficult to till, because of the gravel content. Response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is well suited to the commonly grown cultivated crops and to hay, pasture, and trees. Most areas are cleared. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe-3; woodland suitability group 2o1; wildlife group 1.

Rigley gravelly fine sandy loam, 6 to 12 percent slopes (RgC).—This soil is on stream terraces and alluvial fans. Included in mapping are small areas of Pope and Allegheny soils.

The soil is somewhat difficult to till, because of the gravel content. Response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more.

This soil is well suited to trees, hay, and pasture and to the commonly grown cultivated crops. Most areas

are forested. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-4; woodland suitability group 2o1; wildlife group 1.

Rigley gravelly fine sandy loam, 12 to 20 percent slopes (RgD).—This soil is on toe slopes and short side slopes. Included in mapping are small areas of Cranston and Allegheny soils.

The effective depth for root growth is 48 inches or more.

This soil is well suited to hay, pasture, or trees. It is also suited to occasional cultivation. Most areas are forested. The hazard of erosion is very severe in cultivated areas. Capability unit IVe-1; woodland suitability group 2o1; wildlife group 2.

Rigley gravelly fine sandy loam, 20 to 30 percent slopes (RgE).—This soil is on side slopes. Included in mapping are small areas of Latham and Shelocta soils.

The effective depth for root growth is 48 inches or more.

This soil is suited to pasture, trees, and wildlife habitat. Most areas are forested. The hazard of erosion is too severe for this soil to be suitable for cultivation. Capability unit VIe-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Rigley stony fine sandy loam, 30 to 60 percent slopes (RIF).—This soil is on slightly concave side slopes below sandstone cliffs. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Donahue, Steinsburg, and Cranston soils. Also included are soils that are relatively free of stones on the surface but are gravelly.

The effective depth for root growth is 48 inches or more. Stones and boulders cover 2 to 15 percent of the surface.

Stoniness and steepness of slope severely limit this soil for many uses. Nearly all areas of this soil are forested. It is suited to trees and wildlife habitat. Capability unit VIIs-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Rigley-Donahue complex, 6 to 20 percent slopes (RoD).—This complex is on toe slopes. The deep Rigley soils, which make up about 55 percent of this complex, are on smooth side slopes and in the head of drainageways. The moderately deep Donahue soils, which make up about 35 percent, are on the convex slopes. The soils in this complex are so intermingled that separation in mapping was not considered practical. Each soil has a profile similar to the one described as representative for its series, except that these soils are not stony. Sinkholes are common.

Included with this complex in mapping are small areas of Latham soils and some small areas of soils that are severely eroded. Also included are small areas that have as much as 2 percent stones and limestone outcrops on the surface.

The soils in this complex are suited to most farm crops and to pasture and hay if the strongly sloping areas are cultivated only occasionally. The soils are also suited to trees and wildlife habitat. If these soils are cultivated, the hazard of erosion is very severe. Capability unit IVe-1; woodland suitability group 2o1; wildlife group 2.

Rigley-Donahue complex, 20 to 30 percent slopes (RoE).—This complex is on benchy side slopes. The deep Rigley soils, which make up about 55 percent of this complex, are on concave side slopes and in the head of drainageways. The moderately deep Donahue soils, which make up about 35 percent, have convex slopes. Stones cover from 2 to 15 percent of the surface. Some limestone outcrops are on the surface of the Donahue soils. These soils are so intermingled that mapping them separately was considered impractical.

Included with this complex in mapping are small areas of Brookside and Latham soils.

Steepness, stoniness, and the hazard of erosion are the main limitations to use of these soils. They are suited to trees and wildlife habitat. Most areas are forested. Pasture is difficult to establish and maintain on these soils. Capability unit VIIs-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Rigley-Donahue complex, 30 to 60 percent slopes (RoF).—This complex is on side slopes. The deep Rigley soils, which make up about 55 percent of this complex, are on concave side slopes and in the head of drainageways. The moderately deep Donahue soils, which make up about 35 percent, are on the convex slopes. Stones cover 2 to 15 percent of most areas. Some limestone outcrops are on the surface of the Donahue soils. These soils are so intermingled that mapping them separately was considered impractical. A soil in this complex has the profile described as representative of the Donahue series.

Included with this complex in mapping are small areas of Brookside and Latham soils. Some areas in the head of drainageways are covered by more than 15 percent stones and boulders.

Steepness, stoniness, and the hazard of erosion make the soils in this mapping unit unsuitable for uses other than trees and wildlife habitat. Capability unit VIIs-1; woodland suitability group 2r1 on north-facing slopes and 3r1 on south-facing slopes; wildlife group 3.

Shelocta Series

The Shelocta series consists of deep, well-drained soils on side slopes and colluvial fans. These soils are medium acid to very strongly acid in the surface layer. They formed in colluvium washed from soils derived from acid siltstone and shale. Slopes range from 12 to 50 percent. Shelocta soils are mapped only in complexes with Latham soils.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is 39 inches thick. The upper 6 inches is yellowish-brown heavy silt loam, the next 22 inches is strong-brown light silty clay loam, and the lower 11 inches is yellowish-brown heavy silty clay loam that has pale-brown, strong-brown, and light-gray mottles. The substratum, which extends to a depth of 64 inches, is yellowish-brown channery silty clay that has light-gray, strong-brown, and yellowish-red mottles.

The available water capacity is high, and permeability is moderate. Natural fertility and organic-matter content are low.

Representative profile of Shelocta silt loam in an area of Latham-Shelocta silt loams, 20 to 30 percent slopes, near Yocum Creek, about 4 miles southeast of the North

Fork of Licking River on State Route 1378 and 200 yards north, in Morgan County (Laboratory No. S67KY-88-8):

O11—1½ inches to ½ inch, hardwood leaves and twigs.
O12—½ inch to 0, partially decomposed leaves and twigs.
Ap1—0 to 2 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, granular structure; very friable; many roots; 5 percent shale fragments; strongly acid; abrupt, smooth boundary.
Ap2—2 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and coarse, granular structure; very friable; many roots; 5 percent shale fragments; very strongly acid; abrupt, smooth boundary.
B1t—8 to 14 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak to moderate, fine, subangular blocky structure; friable; faint, patchy clay films; common roots; 5 percent shale fragments; very strongly acid; clear, smooth boundary.
B21t—14 to 26 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, fine to medium, subangular blocky structure; friable; few roots; distinct, patchy clay films; 10 percent shale fragments; extremely acid; clear, wavy boundary.
B22t—26 to 36 inches, strong-brown (7.5YR 5/6) light silty clay loam; weak to moderate, fine and very fine, subangular blocky structure; friable; few roots; faint patchy clay films on peds; 8 percent shale fragments; extremely acid; clear, wavy boundary.
B3t—36 to 47 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; mottles of pale brown (10YR 6/3), strong brown (7.5YR 5/6), and light gray (10YR 7/1); weak to moderate, fine and very fine, subangular blocky structure; friable to firm; few roots; distinct, patchy clay films on peds; 10 percent shale fragments; extremely acid; clear, wavy boundary.
C—47 to 64 inches +, yellowish-brown (10YR 5/4) channery silty clay; many, coarse, prominent mottles of light gray (10YR 7/1), strong brown (7.5YR 5/6), and yellowish red (5YR 5/6); massive; firm; few roots; 30 percent shale fragments; extremely acid.

Depth to hard shale is 48 inches or more. The solum ranges from 42 to 60 inches in thickness. Coarse fragments make up 5 to 20 percent of the A and B horizons and 20 to 60 percent of the C horizon. Where the soils are not plowed, the A1 horizon is dark brown (10YR 3/3 or 10YR 4/3) and is about 2 to 4 inches thick. The B horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/8). The B1 and B2 horizons are silt loam or light silty clay loam. The B3 and C horizons range from channery light silty clay loam to channery silty clay.

Shelocta soils are near Rigley, Gilpin, Whitley, and Latham soils. They contain less sand throughout than Rigley soils. They are deeper than Gilpin soils. They contain more coarse fragments throughout than Whitley soils. They are deeper and contain less clay in the B horizon than Latham soils.

Skidmore Series

The Skidmore series consists of deep, well-drained soils on flood plains. These soils are medium acid or slightly acid. They formed in gravelly alluvium washed from soils derived from siltstone, sandstone, and limestone. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is brown gravelly fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of 32 inches, is dark yellowish-brown gravelly loam and gravelly sandy loam. The substratum is dark yellowish-brown very channery sandy loam. Bedrock is at a depth of 70 inches.

The available water capacity is low to medium, and permeability is moderately rapid. Natural fertility is medium, and organic-matter content is low.

Representative profile of Skidmore gravelly fine sandy loam, about 10 miles northeast of Frenchburg, about ½ mile northwest of intersection of State Routes 1274 and 826, then ¾ mile west on lane, then 50 feet north on flood plain, in Menifee County:

Ap—0 to 6 inches, brown (10YR 4/3) gravelly fine sandy loam; moderate, fine and medium, granular structure; very friable; common fine roots; 15 percent gravel; medium acid; clear, smooth boundary.
B2—6 to 18 inches, dark yellowish-brown (10YR 4/4) gravelly loam; weak, medium, subangular blocky structure; very friable; common fine roots; 20 percent gravel; slightly acid; clear, smooth boundary.
B3—18 to 32 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, medium, subangular blocky structure; very friable; few fine roots; 40 percent gravel; slightly acid; abrupt, smooth boundary.
IIC—32 to 70 inches, dark yellowish-brown (10YR 4/4) very channery sandy loam; single grain; very friable; 80 percent channery fragments and pebbles; few thin strata of loamy fine sand; slightly acid; abrupt, smooth boundary.
IIIR—70 inches +, grayish, hard siltstone.

Depth to bedrock ranges from 40 inches to more than 72 inches. The solum ranges from 20 to 40 inches in thickness. Content of siltstone and sandstone pebbles or fragments ranges from 10 to 35 percent in the A and B2 horizons and from 35 to 80 percent in the B3 and IIC horizons. The A horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). Texture of the fine earth fraction is loam, fine sandy loam, or sandy loam. Structure is weak or moderate, fine or medium, granular. The B and IIC horizons range from brown (10YR 4/3) to reddish yellow (7.5YR 6/6), and in some places these horizons are mottled with two or more of the colors in this range. Texture of the fine earth fraction is loam, fine sandy loam, or sandy loam, and in some places one or two layers of loamy sand or mostly loamy sand are below a depth of 30 inches. Some profiles have mottles, or layers 1 to 2 in chroma, below a depth of 24 inches.

Skidmore soils are near Stendal and Renox soils on flood plains and near Brookside and Rigley soils on uplands. They have a higher content of coarse fragments in the lower part of the B horizon and the C horizon than those soils. Skidmore soils are better drained than Stendal soils. They lack a B horizon of clay accumulation that is in the Renox, Brookside, and Rigley soils.

Skidmore gravelly fine sandy loam (0 to 2 percent slopes) (Sd).—This soil is on first bottoms of flood plains (fig. 10).

Included with this soil in mapping are small areas of a somewhat poorly drained soil and a small acreage of a well-drained soil that is not gravelly. Both included soils are nonacid.

This soil is difficult to till, because the surface layer contains gravel. Response of crops to fertilizer is fair to good. Lime is generally not needed, because reacton is slightly acid to neutral. The effective depth for root growth is restricted below a depth of about 32 inches by a very channery layer.

This soil tends to be droughty, but under good management most of the commonly grown crops, as well as hay and pasture, can be grown. This soil is suited to trees and wildlife habitat. Because it is subject to occasional flooding in winter and spring, fall-seeded crops may be damaged. Most areas are cleared. The hazard of erosion is none to slight. Capability unit IIs-1; woodland suitability group 3f1; wildlife group 8.

Steinsburg Series

The Steinsburg series consists of moderately deep, well-drained soils on rocky ridgetops and steep side slopes of uplands. These soils are very strongly acid.

Figure 10.—Profile of Skidmore gravelly fine sandy loam.

They formed in residuum derived from acid sandstone. They are mapped only in complexes with Ramsey soils. Slopes range from 6 to 40 percent.

In a representative profile the surface layer is dark grayish-brown sandy loam about 3 inches thick. The sandy loam subsoil, which extends to a depth of about 18 inches, is dark yellowish brown in the upper part and yellowish brown in the lower part. The substratum, which reaches to a depth of 26 inches, is strong-brown sandy loam. Sandstone bedrock occurs at a depth of 26 inches.

The available water capacity is low, and permeability is moderately rapid. Natural fertility and organic-matter content are low.

Representative profile of Steinsburg sandy loam in an area of Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes, about 1/4 mile north of the confluence of Craney Creek and the North Fork of the Licking River in Rowan County:

O11—1½ inches to ½ inch, leaves, twigs.

O12—½ inch to 0, partially decomposed leaves and twigs.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; very friable; 2 percent sandstone fragments; many roots; very strongly acid; clear, smooth boundary.

B1—3 to 9 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; very friable; 2 percent sandstone fragments; common roots; very strongly acid; gradual, wavy boundary.

B2—9 to 18 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, subangular blocky structure; very friable, 4 percent sandstone fragments; common roots; very strongly acid; gradual, wavy boundary.

C—18 to 26 inches, strong-brown (7.5YR 5/6) sandy loam; single grain; massive; very friable; 20 percent sandstone fragments; few roots; very strongly acid; abrupt, smooth boundary.

R—26 inches +, sandstone.

Depth to sandstone bedrock is commonly about 26 inches, but it ranges from 24 to 36 inches. The solum ranges from 10 to 20 inches in thickness. Content of coarse fragments ranges from 2 to 20 percent, by volume, throughout the solum and from 20 to 60 percent in the C horizon. The A1 horizon is dark grayish-brown (10YR 4/2) or dark-brown (10YR 4/3 or 10YR 3/3) sandy loam, fine sandy loam, or loam. The B1 horizon ranges from dark yellowish brown (10YR 4/4) to light yellowish brown (10YR 6/4). The B2 and C horizons range from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6). The B1 and B2 horizons are sandy loam or fine sandy loam, and the C horizon is sandy loam or loamy sand.

Steinsburg soils occur near Hartsells, Latham, Rigley, and Ramsey soils. They contain more sand than Hartsells and Latham soils and lack their B horizon of clay accumulation. They are shallower than Rigley soils and deeper than Ramsey soils.

Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes (SrD).—This complex is on narrow ridgetops and upper side slopes. The soils in this mapping unit are so intermingled that it was considered impractical to map them separately. A soil in this complex has the profile described as representative for the Steinsburg series. Steinsburg soils make up about 65 percent of this complex, and Ramsey soils about 25 percent. Rock outcrops are on from 3 to 10 percent of the surface. These soils formed in residuum derived from weathered sandstone. Steinsburg and Ramsey soils have similar qualities, but Ramsey soils are shallower to bedrock and are more droughty. The Steinsburg soils are generally less steep and more distant from the rock outcrops than the Ramsey soils.

Included with this complex in mapping are small areas of Rigley, Latham, and Hartsells soils and a soil that has a subsoil of loamy sand. Also included is a soil that has a yellowish-red subsoil.

These soils are not suited to cultivation, because they are rocky; also, the Ramsey soils are shallow. The soils in this complex are suited to trees, pasture, and wildlife habitat. They are mostly forested. Capability unit VIs-1; woodland suitability group 4x1; wildlife group 4.

Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes (SrF).—The soils in this complex are on upper side slopes. The soils are so intermingled that it was considered impractical to map them separately. A soil in this complex has the profile described as representative for the Ramsey series. About 65 percent of the complex is moderately deep, well-drained Steinsburg soils, and about 25 percent is shallow, somewhat excessively drained Ramsey soils. Rock outcrops are on 3 to 10 percent of the surface. These soils formed in residuum derived from weathered sandstone. Steinsburg and Ramsey soils have similar qualities, but Ramsey soils have a shallower root zone and are more droughty.

Included with this complex in mapping are small areas of Rigley, Latham, and Hartsells soils and a soil that has a subsoil of loamy sand. Also included in most places are areas of sandstone cliffs and a soil that has a yellowish-red subsoil.

These soils are not suited to cultivation or pasture and hay, because they are steep and rocky. They are suited to trees and wildlife habitat. They are mostly forested. Capability unit VIIs-1; woodland suitability group 4x1; wildlife group 4.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils on flood plains. These soils are very strongly acid. They formed in alluvium washed from soils derived from siltstone and sandstone. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is grayish-brown silt loam about 12 inches thick. The subsoil, which extends to a depth of 28 inches, is grayish-brown heavy silt loam that has strong-brown mottles. The substratum, which reaches to a depth of 80 inches, is gray and has yellowish-brown mottles. It is heavy silt loam in the upper part and silty clay loam in the lower part.

The available water capacity is high, and permeability is moderate. Organic-matter content is low, and natural fertility is medium.

Representative profile of Stendal silt loam, near the Licking River about 2½ miles north of Interstate Highway 64 on State Route 1722, about 200 yards west of the road in an old field, in Rowan County:

Ap—0 to 12 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; friable; common roots; common pores; very strongly acid; gradual, wavy boundary.

Bg—12 to 28 inches, grayish-brown (2.5Y 5/2) heavy silt loam; many, medium, distinct mottles of strong brown (7.5YR 5/6); weak, fine, subangular blocky structure; friable; common roots; common pores; very strongly acid; gradual, wavy boundary.

C1g—28 to 55 inches, gray (5Y 6/1) heavy silt loam; common, coarse, prominent mottles of yellowish brown (10YR 5/8); massive; firm, sticky; few roots; very strongly acid; gradual, wavy boundary.

C2g—55 to 80 inches +, gray (N 6/0) silty clay loam; many, coarse, prominent mottles of yellowish brown (10YR 5/6); massive; firm, sticky; few roots; very strongly acid.

Depth to underlying bedrock ranges from 48 to 72 inches or more. The solum ranges from 24 to 40 inches in thickness. The A horizon is grayish brown (10YR 5/2), dark gray (10YR 4/1), or dark grayish brown (10YR 4/2). The Bg horizon is grayish brown (2.5Y 5/2 or 10YR 5/2), dark grayish brown (2.5Y 4/2), or light brownish gray (2.5Y 6/2). The B horizon has mottles of strong brown (7.5YR 5/6), pale olive (5Y 6/4), or yellowish brown (10YR 5/6). The C horizon is gray (5Y 6/1, N 6/0, or 5Y 5/1), olive gray (5Y 5/2), or light olive gray (5Y 6/2). The texture of the Cg horizon ranges from silty clay loam to fine sandy loam.

Stendal soils occur near Morehead and Bonnie soils. They lack the B horizon of clay accumulation of Morehead soils. They are better drained than Bonnie soils.

Stendal silt loam (0 to 2 percent slopes) (St).—This soil is on first bottoms of flood plains. Included with this soil in mapping are small areas of Cuba and Bonnie soils. Also included is a small acreage of a soil that is fine sandy loam throughout and is gravelly in places.

This soil has a seasonal high water table that restricts root growth at a depth of 6 to 18 inches. If adequate drainage is provided, this soil is easily tilled and response of crops to lime and fertilizer is good.

If this soil is artifically drained, it is suited to continuous cultivation. Without drainage, it is suited to pasture and hay plants that tolerate wetness. This soil is suited to trees. If this soil is cultivated, the hazard of erosion is none to slight. This soil is subject to occasonal flooding. Capability unit IIw-1; woodland suitability group 1w1; wildlife group 7.

Stendal Series, Neutral Variant

The Stendal series, neutral variant, consists of deep, somewhat poorly drained soils on flood plains. These soils are neutral. They formed in alluvium that washed from soils derived from limestone, sandstone, and siltstone. Slopes range from 0 to 4 percent.

In a representative profile the surface layer is about 7 inches thick. It is dark-brown fine sandy loam that has gray and yellowish-brown mottles. The subsoil extends to a depth of about 36 inches. The upper 13 inches is grayish-brown fine sandy loam that has gray and dark yellowish-brown mottles, and the lower 16 inches is gray fine sandy loam that has light olive-brown mottles. The substratum, which reaches to a depth of about 60 inches, is olive-gray fine sandy loam.

The available water capacity is high, and permeability is moderately rapid. Natural fertility is high, and organic-matter content is low.

Representative profile of Stendal fine sandy loam, neutral variant, near Scranton, about 1 mile south of State Route 1274 on dirt road up Cold Cave Creek, west about 75 feet near the confluence of Warm Fork and Cold Cave Creek, in Menifee County:

Ap—0 to 7 inches, dark-brown (10YR 4/3) fine sandy loam; many, coarse, distinct mottles of gray (10YR 5/1) and yellowish brown (10YR 5/6); weak, medium, granular structure; very friable; 2 percent gravel; common roots; neutral; gradual, wavy boundary.

B1—7 to 20 inches, grayish-brown (2.5Y 5/2) fine sandy loam; many, medium, distinct mottles of gray (N 6/0) and dark yellowish brown (10YR 4/4); weak, fine, subangular blocky structure; sticky; 2 percent gravel; common roots; neutral; gradual, wavy boundary.

B2—20 to 36 inches, gray (5Y 5/1) fine sandy loam; many, medium, distinct mottles of light olive brown (2.5Y 5/6); weak, fine, subangular blocky structure to massive; sticky; 2 percent gravel; few roots; neutral; gradual, wavy boundary.

C—36 to 60 inches +, olive-gray (5Y 5/2) fine sandy loam; massive; sticky; 2 percent gravel; neutral.

Depth to bedrock ranges from 48 to 72 inches or more. The solum ranges from 24 to 40 inches in thickness. The Ap horizon is dark-brown (10YR 4/3), dark grayish-brown (10YR 4/2), grayish-brown (10YR 5/2), or dark-gray (5Y 4/1) fine sandy loam, silt loam, or loam. The B1 horizon is grayish-brown (2.5Y 5/2 or 10YR 5/2) or dark grayish-brown (10YR 4/2) fine sandy loam or silt loam. The B2 horizon matrix is 10YR, 2.5Y, or 5Y in hue, 5 in value, and 1 or 2 in chroma. This horizon is mottled in shades of brown. The texture is fine sandy loam or loam. The C horizon is 10YR, 5Y, or 2.5Y in hue, 5 in value, and 0 to 2 in chroma. Mottles in shades of brown are in this horizon in some places. Texture ranges from fine sandy loam to silt loam.

Stendal soils, neutral variant, are near Skidmore, Renox, and Cotaco soils on flood plains and Brookside and Rigley soils on uplands. Stendal soils, neutral variant, are less

well drained than any of those soils. They lack the B horizon of clay accumulation of Cotaco, Renox, Brookside, and Rigley soils. They have fewer coarse fragments throughout the profile than Skidmore soils.

Stendal fine sandy loam, neutral variant (0 to 4 percent slopes) (Sv).—This soil is on first bottoms and alluvial fans of flood plains. Included in mapping are small areas of Cotaco and Skidmore soils.

This soil has a seasonal high water table that restricts root growth at a depth of 6 to 12 inches. If adequate drainage is provided, this soil is easily tilled. It is subject to flooding.

If this soil is drained, it is suited to continuous cultivation; and if not, it is suited to hay and pasture plants that tolerate wetness. It is suited to trees. Most areas are cleared. If this soil is cultivated, the hazard of erosion is none to slight. Capability unit IIw-1; woodland suitability group 1w1; wildlife group 7.

Strip Mines

Strip mines (Sx) consists of areas where the soil and rocks above fire clay or a limestone bed have been removed to allow open-pit mining. Extensive acreages of strip mines are near Clack Mountain and Christy Creek in Rowan County near Morehead.

Strip mines generally consist of a high vertical wall on one side, a spoil bank on the other side, and a pond of water between. The high wall is the vertical face on the upper side of the mining pit above the fire clay or limestone. Sloughing from this high wall is common. The spoil bank consists of soil, shale, sandstone, and fire clay and limestone waste material. This mixture is spilled downhill or deposited downslope from the pit. These spoil banks tend to slump badly when saturated with water. In some places this slumping releases the water in the pond between the spoil bank and the high wall. The water, when released, carries silt and other pollutants into the streams. Spoil banks have a high surface temperature, tend to be droughty, are highly erodible, and have very low natural fertility and moderately slow permeability.

A continuous cover crop, a good mulch of litter, and trees that have a deeply penetrating root system help significantly to stablize these areas. Because the physical characteristics, as well as other features that affect use, are variable, investigation at each site is needed to determine suitability for a specific use. Not placed in a capability unit, woodland suitability group, or wildlife group.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils that have a fragipan. These soils are on high stream terraces and broad ridgetops on uplands. They formed in alluvium or residuum derived from acid siltstone and shale. They are very strongly acid. Slopes range from 2 to 12 percent.

In a representative profile the surface layer, about 5 inches thick, is grayish-brown silt loam that has pale-brown mottles. The subsoil is 51 inches thick. The upper 19 inches is yellowish-brown silt loam that has light brownish-gray and strong-brown mottles in the lower 5 inches; and the lower 32 inches is a firm, compact fragipan layer, the upper part of which is light olive-brown silt loam that has light brownish-gray and strong-brown mottles, and the lower part of which is mottled light brownish-gray, light olive-brown, and strong-brown silt loam. The substratum is mottled yellowish-brown, strong-brown, and olive-gray silt loam. Bedrock is at a depth of about 65 inches.

The available water capacity is medium, and permeability is slow. Natural fertility and organic-matter content are low.

Representative profile of Tilsit silt loam, 2 to 6 percent slopes, 50 yards west of State Route 801 at a point 1¼ miles south of the junction of State Routes 801 and 158, about 8 miles northwest of Morehead near the Fleming County line, in Rowan County:

O11—1 to ½ inch, leaves and pine needles.

O12—½ inch to 0, partially decomposed leaves and pine needles.

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam; few, fine, faint mottles of pale-brown (10YR 6/3); weak, fine and medium, granular structure; very friable; many fine roots; very strongly acid; abrupt, smooth boundary.

B1—5 to 9 inches, light yellowish-brown (10YR 6/4) silt loam; weak, very fine and fine, subangular blocky structure; very friable; common fine roots; very strongly acid; clear, smooth boundary.

B21t—9 to 19 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, fine and medium, subangular and angular blocky structure; friable; few fine roots, pores, and cavities; thin clay films on most peds and cavities; 1 percent small siltstone fragments; very strongly acid; clear, smooth boundary.

B22t—19 to 24 inches, yellowish-brown (10YR 5/4) heavy silt loam; common, medium, distinct mottles of light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6); moderate, fine and medium, subangular blocky structure; firm; few small roots, pores, and cavities; thin clay films on most peds and in cavities; 1 percent siltstone fragments; very strongly acid; clear, smooth boundary.

Bx1—24 to 44 inches, light olive-brown (2.5Y 5/6) heavy silt loam; many, medium and coarse, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8); moderate, medium, platy structure parting to weak, very fine, angular blocky; very firm, brittle and compact; few small pores and cavities; thin, patchy clay films; few vertical cracks filled with grayish silt loam, distinct clay films; 2 percent siltstone fragments; very strongly acid; gradual, smooth boundary.

Bx2—44 to 56 inches, mottled, medium and distinct, light-brownish-gray (2.5Y 6/2), light olive-brown (2.5Y 5/6) and strong-brown (7.5Y 5/6) heavy silt loam; weak, thick, platy structure parting to weak, very fine, angular blocky; firm, brittle and compact; thin, very patchy clay films; 5 percent small siltstone fragments; very strongly acid; gradual, smooth boundary.

C—56 to 65 inches, mottled, medium and distinct, yellowish-brown (10YR 5/4), strong-brown (7.5YR 5/6), and olive-gray (5Y 5/2) silt loam; massive; firm; 40 percent soft siltstone fragments and a few soft shale fragments; very strongly acid; clear, smooth boundary.

R—65 inches +, siltstone rock; hard.

Depth to underlying bedrock ranges from 40 to 72 inches or more. The solum ranges from 40 to 60 inches in thickness. Depth to the fragipan ranges from 18 to 28 inches. The Ap horizon is grayish brown (10YR 5/2), brown (10YR 5/3), or dark grayish brown (10YR 4/2). The A1 horizon in unplowed areas is 2 to 5 inches thick and is dark brown (10YR 4/3 or 10YR 3/3). The B1 and B2t horizons range from light yellowish-brown (10YR 6/4) to yellowish-brown (10YR 5/6) silt loam or light silty clay loam. The Bx horizon ranges

from yellowish brown (10YR 5/6) to light yellowish brown (2.5Y 6/4). Mottles are in shades of brown and gray. The Bx horizon is silt loam or light silty clay loam and ranges from 20 to 42 inches in thickness.

Tilsit soils are near Cranston, Johnsburg, and Morehead soils. They have less gravel in the solum than Cranston soils. They are better drained than Johnsburg and Morehead soils. They have a fragipan, which Cranston and Morehead soils lack.

Tilsit silt loam, 2 to 6 percent slopes (TlB).—This soil is on high terraces and broad ridgetops. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Whitley and Johnsburg soils. Also included is a soil that has a thicker subsoil than this Tilsit soil.

This soil has a seasonal high water table at a depth of 18 to 24 inches. This soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is restricted to about 24 inches because of the location of the fragipan.

This soil is suited to trees, most of the commonly grown cultivated crops, hay, and pasture. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe-2; woodland suitability group 3o1; wildlife group 1.

Tilsit silt loam, 6 to 12 percent slopes (TlC).—This soil is on high terraces and broad ridgetops.

Included with this soil in mapping are small areas of Latham and Johnsburg soils. Also included is a soil that has a thicker subsoil than this Tilsit soil.

This soil is subject to a seasonal high water table at a depth of 18 to 24 inches. The soil is easily tilled, and response of crops to lime and fertilizer is good. The effective depth for root growth is restricted to about 24 inches by the fragipan.

This soil is suited to trees, most of the commonly grown cultivated crops, hay, and pasture. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe-3; woodland suitability group 3o1; wildlife group 1.

Trappist Series

The Trappist series consists of moderately deep, well-drained soils on uplands; the soils are on upper side slopes and convex points of ridges. These soils are very strongly acid. They formed in residuum derived from black shale. Slopes range from 30 to 60 percent. Trappist soils are mapped only in a complex with Muse soils.

In a representative profile the surface layer is silt loam about 6 inches thick. It is very dark grayish brown in the upper 2 inches and brown in the lower 4 inches. The subsoil, which extends to a depth of 28 inches, is strong brown. It is silty clay loam in the upper 3 inches and silty clay in the lower 19 inches. The substratum is mottled yellowish-red, yellowish-brown, and light brownish-gray very shaly clay. Bedrock is at a depth of about 35 inches.

The available water capacity is medium, and permeability is moderately slow. Natural fertility and organic-matter content are low.

Representative profile of Trappist silt loam in an area of Muse-Trappist stony silt loams, 30 to 60 percent slopes, about 1 mile north of Farmers, 80 feet east of State Route 801 in Rowan County:

O11—½ to ¼ inch, hardwood leaves and pine needles.

O12—¼ inch to 0, partially decomposed leaves and needles.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable; many roots; 5 percent shale fragments; very strongly acid; abrupt, smooth boundary.

A2—2 to 6 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; many roots; 5 percent shale fragments; very strongly acid; abrupt, smooth boundary.

B1t—6 to 9 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, fine, subangular blocky structure; friable; common roots; few clay films; 5 percent shale fragments; very strongly acid; gradual, smooth boundary.

B2t—9 to 21 inches, strong-brown (7.5YR 5/6) silty clay; moderate, medium, subangular blocky structure; firm, sticky, slightly plastic; common roots; common clay films; 10 percent shale fragments; very strongly acid; gradual, wavy boundary.

B3t—21 to 28 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, distinct mottles of yellowish red (5YR 4/6) and light yellowish brown (10YR 6/4); moderate, medium, angular blocky structure; very firm, sticky, plastic; common clay films; 10 percent shale fragments; very strongly acid; gradual, wavy boundary.

C—28 to 35 inches, mottled yellowish-red (5YR 4/6), yellowish-brown (10YR 5/6), and light brownish-gray (10YR 6/2) very shaly clay; relict platy structure; very firm, sticky, plastic; 60 percent shale fragments; very strongly acid; clear, wavy boundary.

R—35 inches +, hard, black acid shale.

Depth to hard shale ranges from 24 to 36 inches. The solum ranges from 22 to 36 inches in thickness. Content of coarse fragments ranges from 5 to 35 percent in the A and B horizons and from 25 to 75 percent in the C horizon. The A1 horizon is very dark grayish-brown (10YR 3/2) or dark grayish-brown (2.5Y 4/2 or 10YR 4/2) silt loam or light silty clay loam. The Bt horizon ranges from dark reddish brown (5YR 4/4) to strong brown (7.5YR 5/8). The B2t and B3t horizons range from heavy silty clay loam to clay and their shaly analogs. Mottles in the B3t and C horizons are red, brown, or gray.

Trappist soils are near Berks and Muse soils. They are more clayey and contain fewer coarse fragments in the B horizon than Berks soils. They are not so deep as Muse soils.

Whitley Series

The Whitley series consists of deep, well-drained soils on low stream terraces and broad ridgetops on uplands. These soils are very strongly acid. They formed in alluvium or residuum derived from acid siltstone and shale. Slopes range from 0 to 12 percent on terraces and 6 to 20 percent on uplands.

In a representative profile the surface layer is silt loam about 7 inches thick. It is dark grayish brown in the upper 3 inches and yellowish brown in the lower 4 inches. The subsoil is 31 inches thick. The upper 14 inches is yellowish-brown silt loam, the next 8 inches is yellowish-brown light silty clay loam, and the lower 9 inches is brownish-yellow light silty clay loam that has pale-brown and strong-brown mottles. Bedrock is at a depth of about 38 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is medium.

Representative profile of Whitley silt loam, 6 to 12 percent slopes, about 1 mile east of the Menifee County line and almost ½ mile east of Bear Branch, in Morgan County:

O11—1¼ inches to ¼ inch, hardwood leaves and twigs.

O12—¼ inch to 0, partially decomposed leaves and twigs.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint mottles of light olive brown (2.5Y 5/4); weak, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

A2—3 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, granular structure to weak, fine, subangular blocky; friable; many roots; very strongly acid; clear, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak, fine, subangular blocky structure; friable; few roots; very strongly acid; clear, wavy boundary.

B21—12 to 21 inches, yellowish-brown (10YR 5/6) silt loam; weak to moderate, fine and medium, subangular blocky structure; friable; distinct, patchy clay films on peds; 2 to 3 percent shale fragments; few roots; very strongly acid; clear, wavy boundary.

B22t—21 to 29 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, fine, faint mottles of pale brown (10YR 6/3); weak to moderate, fine and medium, subangular blocky structure; friable to firm; distinct, patchy clay films on peds; 3 to 4 percent shale fragments; few roots; very strongly acid; clear, wavy boundary.

B3—29 to 38 inches, brownish-yellow (10YR 6/6) light silty clay loam; common, fine, faint mottles of pale brown (10YR 6/3) and strong brown (7.5YR 5/6); weak, fine and very fine, subangular blocky structure; friable to firm; 15 percent weathered sandstone and shale fragments; few roots; very strongly acid; clear, wavy boundary.

R—38 inches +, weathered shale and sandstone and some mica flakes; light-gray (10YR 7/1), light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) silt loam to light silty clay loam; very strongly acid.

Depth to hard bedrock is 38 inches or more. Content of coarse fragments ranges from 0 to 5 percent in the A1, B1, and B2t horizons and from 5 to 20 percent in the B3 horizon and in the C horizon, where it is present. The A1 horizon, or the Ap horizon where the soil is plowed, ranges from dark yellowish brown (10YR 4/4) to brown (7.5YR 4/2). The B horizon ranges from strong-brown (7.5YR 5/8) to light yellowish-brown (10YR 6/4) silt loam or light silty clay loam.

Whitley soils are near Shelocta, Morehead, Cuba, Tilsit, and Latham soils. They contain fewer coarse fragments throughout than Shelocta soils. They are better drained than Morehead soils. They have a B horizon of clay accumulation that Cuba soils lack. Whitley soils lack the fragipan of Tilsit soils. They are less clayey in the B horizon than Latham soils.

Whitley silt loam, 6 to 12 percent slopes (WhC).—This soil is on broad ridgetops. It has the profile described as representative for the series. Included in mapping are small areas of Tilsit and Latham soils.

The effective depth for root growth is about 40 inches. Organic-matter content is low.

This soil is suited to trees, most of the commonly grown cultivated crops, hay, and pasture. Most areas are forested. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe–1; woodland suitability group 2o1; wildlife group 1.

Whitley silt loam, 12 to 20 percent slopes (WhD).—This soil is on short side slopes and ridgetops. Included in mapping are small areas of Latham and Shelocta soils.

The effective depth for root growth is about 36 inches. Organic-matter content is low.

This soil is suited to trees, hay, and pasture and to occasional cultivation. Most areas are forested. If this soil is cultivated, the hazard of erosion is very severe. Capability unit IVe–1; woodland suitability group 2o1; wildlife group 2.

Whitley silt loam, terrace, 0 to 2 percent slopes (WtA).—This soil is on low stream terraces. It has a profile similar to the one described as representative for the series, but fewer coarse fragments are in the lower part and the subsoil is redder and thicker. Included in mapping are small areas of Cuba and Morehead soils.

This soil is easily tilled, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more. Organic-matter content is medium. Some areas are subject to flooding.

This soil is well suited to all the commonly grown cultivated crops and to hay and pasture. It is also suited to trees and wildlife habitat. If this soil is cultivated, the hazard of erosion is none to slight. Capability unit I–2; woodland suitability group 2o1; wildlife group 8.

Whitley silt loam, terrace, 2 to 6 percent slopes (WtB).—This soil is on low stream terraces. It has a profile similar to the one described as representative for the series, but fewer coarse fragments are in the lower part and the subsoil is redder and thicker. Included in mapping are small areas of Morehead soils and of a soil that is similar to this Whitley soil but that has 15 to 25 percent coarse fragments throughout the profile.

This soil is easily tilled, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more. Organic-matter content is medium.

This soil is well suited to all of the commonly grown cultivated crops and to hay and pasture. It is also suited to trees and wildlife habitat. If this soil is cultivated, the hazard of erosion is moderate. Capability unit IIe–1; woodland suitability group 2o1; wildlife group 1.

Whitley silt loam, terrace, 6 to 12 percent slopes (WtC).—This soil is on short slopes of stream terraces and on toe slopes. It has a profile similar to the one described as representative for the series, but the subsoil is redder and thicker. Included in mapping are small areas of Cranston and Tilsit soils.

This soil is easily tilled, and the response of crops to lime and fertilizer is good. The effective depth for root growth is 48 inches or more. Organic-matter content is low.

This soil is suited to most of the commonly grown cultivated crops and to hay and pasture. It is also suited to trees and wildlife habitat. Most areas are cleared. If this soil is cultivated, the hazard of erosion is severe. Capability unit IIIe–1; woodland suitability group 2o1; wildlife group 1.

Use and Management of the Soils

This section is designed to help the landowner understand how soils behave and how they can be used. In it are discussed the use and management of soils for woodland, for crops and pasture, for wildlife, for engineering, for watershed management, and for town and country planning.

Use of the Soils for Woodland [2]

The original hardwood forest that covered most of the survey area included many species. The dominant species were oak, yellow-poplar, hickory, and American chestnut. Some hemlock and white pine grew in coves, on the side slopes of deep valleys, and on bottom lands. Virginia, shortleaf, and pitch pines grew near cliffs and on droughty ridgetops.

The original forest was logged by landowners who took the best quality, highest value species and then later cleared the rest for farming. Except for the better, gently sloping soils, much of the farmland was eventually abandoned, mainly because of low productivity. The abandoned farmland reverted naturally to forest, mostly pine or a pine-hardwood mixture. Pine is currently common in the area. Most of the forest land has been burned over at least once, and many areas have been repeatedly burned by farmers to encourage the growth of range plants for livestock. Today, most of the steep soils are forested and fires are controlled. About 80 percent of the survey area is forested.

Several major forest types are in this area. The pine-oak forest type is largely shortleaf pine associated with Virginia pine, pitch pine, white oak, chestnut oak, black oak, scarlet oak, pignut and mockernut hickories, and blackgum. Common understory species are sourwood, sassafras, and dogwood. Ground vegetation consists of blueberry, mountain-laurel, greenbrier, wild grape, brackenfern, beggars-lice, and false solomon-seal. This type occurs on narrow to broad ridges and upper side slopes that have a southerly aspect. Major soils in these areas are in the Berks, Latham, Ramsey, and Steinsburg series.

The oak-hickory forest type consists predominantly of scarlet, black, white, and chestnut oaks and hickory associated with an occasional blackgum and Virginia and shortleaf pine. Understory species commonly present are blackgum, sourwood, dogwood, sassafras, red maple, serviceberry, beech, and some yellow-poplar. The ground vegetation consists of greenbrier, sassafras, blueberry, foxglove, grass, beggars-lice, poison-ivy, and some Christmas fern. This type is on steep side slopes that have southerly aspects and on ridgetops. Major soils in these areas are in the Berks, Gilpin, Latham, Ramsey, and Steinsburg series.

The oak forest type is similar to the oak-hickory type but is on less dry sites. Some southern and northern red oak, ash, and yellow-poplar trees are in this type. Occasionally this type is a pure stand of white oak. Shrubs and ground vegetation are similar to but are more abundant than that in the oak-hickory type. Major soils in areas of this forest type are in the Cranston, Donahue, Rigley, and Shelocta series.

The oak-yellow-poplar forest type is largely yellow-poplar, white oak, and black oak. Associated trees are scarlet and red oaks, shagbark hickory, hemlock, white pine, beech, ash, and blackgum. The understory consists of sugar maple, beech, Ohio buckeye, elm, cucumbertree, and basswood. Common shrubs are dogwood, pawpaw, redbud, oaks, beech, spicebush, sugar maple, and red maple. The ground vegetation consists of many ferns, wild ginger, solomons-seal, beggars-lice, wild sweetpotato, wild geranium, and Virginia creeper. This type is on steep side slopes that have northerly aspects and along drainageways. Major soils in these areas are in the Brookside, Cranston, Rigley, and Shelocta series.

The yellow-poplar-hemlock forest type is largely hemlock, white pine, northern red oak, beech, yellow-poplar, and white oak. Common associated trees are basswood, cucumbertree, black walnut, ash, Ohio buckeye, sugar maple, and shagbark hickory. In the understory are bigleaf magnolia, black birch, and serviceberry. The shrub layer has wild hydrangea, spicebush, black cherry, elm, redbud, dogwood, and sugar maple. The ground vegetation has many moist-site species such as rattlesnake-root, maidenhairfern, Christmas fern, walkingfern, wild ginger, hepatica, bellwort, bloodroot, coralbells, jack-in-the-pulpit, and dogtooth violet. This climax type is in steep coves and on slopes below large cliffs and is commonly on northerly aspects. These sites are moist and in many places are medium to high in fertility. Major soils in these sites are in the Brookside, Rigley, and Shelocta series.

Local markets provide outlets for rough lumber, posts, ties, pallets, and pulpwood. Additional local markets are needed for low-grade hardwoods that can be used for small-dimension stock.

Some of the important soil characteristics that affect growth of trees are available water capacity, depth to bedrock, texture, drainage, and depth to fragipan.

Many of the soils in the area have the potential to produce larger and better quality wood crops than are currently being produced. Improved woodland management that applies information about soils will be needed in much of the area to realize this potential.

Soils influence the growth and management of trees. The soils in the survey area have been studied and, on the basis of the data obtained, placed in woodland suitability groups according to soil productivity for the principal tree species, according to the degree and type of limitation for woodland use, and according to species preferred in native stands and for planting. This information is given in table 2. In the following paragraphs some of the column headings in table 2 are explained, beginning with an explanation of the woodland suitability group symbol. For the woodland suitability group in which each soil has been placed, refer to the "Guide to Mapping Units" at the back of this survey.

Woodland Classes, the broadest groups, are designated by Arabic numerals 1 through 6. The numerals indicate progressively lower productivity for woodland products from the tree species that are adapted to a specific soil. Class 1 soils produce the highest yields, and class 6 soils the lowest.

Woodland Subclasses are subdivisions within a class. They are designated by adding a small letter, *x*, *w*, *c*, *f*, *r*, or *o* to the class numeral; for example 3f. These subclasses are based on soil properties that limit management and are defined as follows:

x (stoniness or rockiness).—Soils in which stones or rocks restrict limit woodland use or management.

[2] Assistance in preparing this section was provided by Charles Foster, staff forester, Soil Conservation Service, and Larry P. Ford, forester, Forest Service.

w (excessive wetness).—Soils in which excessive water, either seasonally or year long, significantly limits woodland use and management. These soils have restricted drainage, a fluctuating or permanently high water table, or a hazard of overflow that adversely affects either stand development or management.

c (clayey soils).—Soils in which the kind and amount of clay in the profile restricts or limits woodland use or management due to the type and amount of clay in the profile.

TABLE 2.—*Woodland*

[Strip mines (Sx) was not placed in a woodland suitability group, because

Woodland suitability groups	Potential productivity		
	Species	Site index	Average annual growth
			Bd ft per acre
Group 1o1: Nearly level, deep, well-drained soils on flood plains; very high potential productivity. Cu, Po, Pp.	Yellow-poplar Upland oak Shortleaf pine	95+ 85+ 85+	495+ 350+ 820+
Group 1w1: Nearly level, deep, poorly drained to somewhat poorly drained soils on flood plains; very high potential productivity. Bo, Mr, St, Sv.	Sweetgum Cottonwood Pin oak	95+ 95+ 95+	500+ 570+ 450+
Group 2o1: Gently sloping to strongly sloping, dominantly deep, well-drained soils; high potential productivity. Some soils are moderately deep. AlB, AlC, AlD, ChB, CrB, CrC, CrD, HaC, HaD, ReB, ReC, RgB, RgC, RgD, RoD, WhC, WhD, WtA, WtB, WtC.	Yellow-poplar Upland oak	85–95+ 75–85	380–495+ 240–350
Group 2r1: Moderately steep and steep, dominantly deep, well-drained soils on north and east aspects; high potential productivity. Some soils are stony, and some are moderately deep. CrE, CrF, RgE, RlF, RoE,[1] RoF.[1] For these soils on south and west aspects, see group 3r1.	Upland oak Yellow-poplar Shortleaf pine	75–85 85–95 75–85	240–350 380–495 670–820
Group 2c2: Moderately steep to steep, moderately deep to deep, dominantly well-drained soils on north and east aspects; high potential productivity. BrF, LaE, LsE, LsF, MsE, MtF.[2] For these soils on south and west aspects, see group 3c2.	Upland oak Yellow-poplar	75–85 85–95	240–350 380–495
Group 2w1: Nearly level, deep, moderately well drained to somewhat poorly drained soils on terraces and uplands; high potential productivity. CoB, Jo, Mp.	Sweetgum Pin oak	85–95 85–95	380–495 345–450
Group 3o1: Gently sloping to strongly sloping, moderately deep or deep, dominantly moderately well drained soils that have a fragipan; on terraces and ridgetops; moderate potential productivity. GlC, GlD, MoB, TlB, TlC.	Upland oak Shortleaf pine Yellow-poplar	65–75 65–75 80–90	150–240 540–670 330–440
Group 3r1: Moderately steep and steep, dominantly deep, well-drained soils on south and west aspects; moderate potential productivity. Some soils are stony. CrE, CrF, RgE, RlF, RoE, RoF. For these soils on north and east aspects, see group 2r1.	Upland oak Shortleaf pine	65–75 65–75	150–240 540–670
Group 3f1: Nearly level, well-drained, droughty soils on flood plains; shallow over gravel; moderate potential productivity. Ck, Sd.	Upland oaks Yellow-poplar	65–75 75–85	150–240 275–380
Group 3f2: Very steep, moderately deep, well-drained soils on upper slopes of north and east aspects; moderate potential productivity. BeF. For this soil on south and west aspects, see group 4f1.	Chestnut oak Shortleaf pine Virginia pine	65–75 65–75 65–75	160–240 540–670 450–540
Group 3c1: Gently sloping to strongly sloping, mainly clayey, moderately deep to deep, well drained and moderately well drained soils on ridgetops and toe slopes; moderate potential productivity. LaC, LaD, LsD,[3] MsB, MsC, MsD.	Upland oak Shortleaf pine	65–75 65–75	150–240 540–670

f (fragmental or skeletal soils).—Soils in which the amount of fragments between 2 millimeters and stone size in the profile restricts or limits woodland use or management.

r (relief or slope steepness).—Soils in which only steepness restricts or limits woodland use or management.

o (slight or no limitations).—Soils in which nothing significantly restricts or limits woodland use or management.

interpretations

the soil material is variable and onsite examination is needed to determine suitability]

	Hazards and limitations			Preferred species	
Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	In existing stands	For planting
Slight	Slight	Slight	Severe	Yellow-poplar, northern red oak, black oak, white oak, black walnut, white pine.	Yellow-poplar, white pine, black walnut, northern red oak, black locust, shortleaf pine, white ash.
Slight	Moderate to severe.	Moderate	Severe	Sweetgum, cottonwood, pin oak, sycamore; also yellow-poplar in better drained areas.	Sweetgum, cottonwood, pin oak, sycamore.
Slight	Slight	Slight	Moderate	Black oak, white oak, yellow-poplar, northern red oak.	Northern red oak, yellow-poplar, white pine, shortleaf pine, black locust.
Severe	Severe	Slight	Moderate	Black oak, white oak, northern red oak, scarlet oak, yellow-poplar, white pine, shortleaf pine.	Yellow-poplar, northern red oak, white pine, shortleaf pine.
Moderate to severe.	Moderate to severe.	Slight	Moderate	Yellow-poplar, black oak, northern red oak, white oak, white pine; also black walnut and white oak on Brookside soils.	Yellow-poplar, white pine, northern red oak, shortleaf pine; also black walnut on Brookside soils.
Slight	Moderate	Slight	Severe	Sweetgum, pin oak, sycamore, hickory.	Sweetgum, pin oak, sycamore.
Slight	Slight	Slight	Moderate	Black oak, scarlet oak, northern red oak, shortleaf pine, yellow-poplar on toe slopes or protected areas.	White pine, shortleaf pine.
Severe	Severe	Slight	Moderate	Chestnut oak, scarlet oak, black oak, shortleaf pine.	Shortleaf pine, white oak, Virginia pine.
Slight	Slight	Moderate	Moderate	White oak, yellow-poplar, red oak, sycamore.	Shortleaf pine, Virginia pine, black locust, white pine.
Moderate	Severe	Slight	Slight	Chestnut oak, Virginia pine, shortleaf pine.	Shortleaf pine, Virginia pine.
Slight to moderate.	Moderate	Slight (Moderate on exposed slopes).	Moderate	White oak, black oak, scarlet oak, shortleaf pine, white pine.	Shortleaf pine, Virginia pine, white pine.

TABLE 2.—*Woodland*

Woodland suitability groups	Potential productivity		
	Species	Site index	Average annual growth
			Bd ft per acre
Group 3c2: Moderately steep to steep, mainly clayey, moderately deep to deep, dominantly well-drained soils on south and west aspects; moderate potential productivity. BrF, LaE, LsE,[3] LsF,[3] MsE, MtF. For these soils on north and east aspects, see group 2c2.	Upland oak	65–75	150–240
Group 3x1: Sloping to moderately steep, rocky, moderately deep, well-drained soils on ridgetops and upper slopes; moderate potential productivity. DoD, DoF.	Upland oak Shortleaf pine	65–75 65–75	150–240 540–670
Group 4f1: Very steep, moderately deep, well-drained soils on upper slopes of south and west aspects; low potential productivity. BeF. For this soil on north and east aspects, see group 3f2.	Chestnut oak Shortleaf pine Virginia pine	55–65 55–65 55–65	90–160 420–540 370–450
Group 4x1: Sloping to moderately steep, rocky, moderately deep or shallow, well-drained or excessively drained soils on ridgetops and upper slopes; low potential productivity. SrD, SrF.	Upland oak Shortleaf pine	55–65 55–65	90–160 420–540

[1] Donahue soils mapped with Rigley soils in this complex have moderate potential productivity.
[2] Trappist soils mapped with Muse soils in this complex have moderate potential productivity.
[3] Shelocta soils mapped with Latham soils in this complex have high potential productivity.

WOODLAND SUITABILITY GROUPS are subdivisions within the subclasses. The factors considered in placing each soil in a woodland suitability group include: (1) potential productivity for several species of tree, (2) species to favor in managing existing woodland, (3) species preferred for planting, and (4) critical soil-related hazards and limitations to be considered in woodland management with respect to erosion, use of equipment, seedling mortality, and plant competition.

Woodland suitability groups are generally designated by adding an Arabic numeral to the subclass symbol; for example, 2w1. Thus, in a woodland suitability symbol, the first Arabic numeral designates the class, or productivity potential; the small letter indicates the subclass, or kind of limitation; and the second Arabic numeral, assigned on a statewide basis, specifically identifies the woodland suitability group within each subclass. Not all of the groups in the State are in this survey area.

The potential productivity within each group is expressed as site index, which is the expected height in feet that trees of a specified species will attain on a specified soil or group of soils at a specified age—50 years for most species. These site index ratings are expressed as a range in height.

For fast-growing species such as yellow-poplar, pin oak, sweetgum, and cottonwood, class 1 soils have a site index of more than 95; class 2 soils have a site index of 85 to 95; class 3 soils have a site index of 75 to 85; class 4 soils have a site index of 65 to 75; class 5 soils have a site index of 55 to 65; and class 6 soils have a site index of less than 55.

For species that have a moderate growth rate, such as oak, Virginia pine, and shortleaf pine, class 1 soils have a site index of more than 85; class 2 soils have a site index of 75 to 85; class 3 soils have a site index of 65 to 75; class 4 soils have a site index of 55 to 65; class 5 soils have a site index of 45 to 55; and class 6 soils have a site index of less than 45.

For slow-growing species, such as redcedar, class 1 soils have a site index of more than 65; class 2 soils have a site index of 55 to 65; class 3 soils have a site index of 45 to 55; class 4 soils have a site index of 35 to 45; and class 5 soils have a site index of less than 35.

On some soils, higher productivity has been measured on north and east aspects than on south and west aspects. Generally, aspect differences are taken into account for soils that have slopes of 20 percent or more.

South and west aspects are generally delineated as the azimuth range from 135 to 315 degrees. North and east aspects are the remainder of the azimuth circle.

Many trees in this survey area and in adjacent areas were measured and the soils described at each site in the process of gathering data from which to determine the site indices for wood crops. As nearly as possible, the studies were confined to well-stocked, naturally occurring, even-aged, essentially unmanaged stands that had not been adversely affected by fire, insects, or disease and had not been grazed to a damaging extent.

The average height and age measurements for most species were converted to a site index by using site index curves in published research (*3*, *4*, *5*, *7*, *12*, *17*). Unpublished field studies by the Tennessee Valley Authority of 271 plots were used to determine the site indices for eastern redcedar.

A site index can be converted to a columetric prediction of growth and yield, which can be shown in wood measurements such as board feet per acre.

interpretations—Continued

Hazards and limitations				Preferred species	
Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	In existing stands	For planting
Moderate to severe.	Severe	Moderate	Moderate	White oak, black oak, scarlet oak, shortleaf pine, white pine.	White pine, shortleaf pine, Virginia pine.
Moderate to severe.	Severe	Slight (Moderate on exposed slopes).	Moderate	White oak, black oak, scarlet oak, white ash, black walnut.	Shortleaf pine, Virginia pine, black locust.
Moderate	Severe	Severe	Slight	Chestnut oak, Virginia pine, shortleaf pine.	Shortleaf pine, Virginia pine.
Moderate to severe.	Severe	Slight (Moderate on exposed slopes).	Slight	White oak, black oak, scarlet oak, hickory.	Shortleaf pine, Virginia pine, black locust.

Predictions of average yearly growth per acre are given in board feet according to the International 1/4-inch rule and are based on published data (*10*, *16*, *17*, *18*) and on evaluations by the Soil Conservation Service. Estimates were made for oak and yellow-poplar up to an age of 60 years and for other species up to an age of 50 years.

The hazard of erosion is the degree of potential soil erosion that may occur where the soil is exposed following cutting operations and along roads, skid trails, fire lanes, and landing areas. It is assumed that the woodland is well managed and is protected from fire and grazing. The main soil characteristics or properties considered in rating the hazard of erosion are slope, rate of infiltration, permeability of the subsoil, water storage capacity, and resistance to detachment of soil particles by forces of rainfall and runoff. The ratings indicate the intensity of measures needed to reduce erosion. The rating is *slight* if no special measures are needed, the rating is *moderate* if some attention needs to be given to the prevention of soil erosion, and the rating is *severe* if intensive erosion-control measures are needed. Erosion can be kept to a minimum by taking care in locating, constructing, and maintaining roads, trails, fire lanes, and landings.

The equipment limitation is influenced by topographic features and soil characteristics such as slope, drainage, texture, stoniness, and rockiness. These restrict the use of conventional wheel or track-type equipment for harvesting and planting wood crops, for constructing roads and for controlling fire and unwanted vegetation. Topographic conditions or differences in soils may necessitate using different types of equipment and methods of operation or varying the season when equipment is used. Generally, the limitation is *slight* if slope is 20 percent or less, soil wetness is not a problem, and farm machinery can be operated efficiently without construction and maintenance of permanent roads and truck trails. The limitation is *moderate* if slope is 20 to 30 percent, if the use of ordinary farm machinery is limited, if track-type equipment is necessary for efficient harvesting, or if soil wetness prevents the use of logging vehicles for 2 to 6 months. The limitation is *severe* if the slope is more than 30 percent and if track-type equipment is not adequate for harvesting and power vehicles and other special equipment are needed, or if wetness prevents the use of vehicles for 6 months or more.

Seedling mortality, which is the mortality of naturally occurring or planted tree seedlings, is influenced by such soil characteristics as drainage, effective rooting depth, texture of the surface layer, and aspect. Plant competition is not considered in these ratings. The rating is *slight* if expected mortality is 0 to 25 percent, *moderate* if expected mortality is 25 to 50 percent, and *severe* if expected mortality is more than 50 percent. If the rating is moderate or severe, replanting is likely to be needed to insure a fully stocked stand, and special preparation of the seedbed and special planting techniques are often necessary.

Plant competition is the invasion of unwanted trees, vines, shrubs, and other plants on a site when openings are made in the canopy. This competition hinders the establishment and normal development of desirable seedlings, whether they occur naturally or are planted. Soil characteristics that influence plant competition are drainage, productivity, acidity, and tree growth characteristics. Plant competition is *slight* if unwanted plants

do not prevent adequate natural regeneration, interfere with early growth, or restrict the normal development of planted stock. Competition is *moderate* if unwanted plants delay establishment and hinder the growth of either planted stock or naturally regenerated seedlings or if they retard the eventual development of a fully stocked stand. Competition is *severe* if unwanted plants prevent adequate restocking, either by natural regeneration or by planting, without intensive site preparation or special maintenance practices.

Use of the Soils for Crops and Pasture

This section is a guide to the suitability and management of the soils for crops and pasture. It has four main parts.

In the first part some general principles of soil management are discussed. In the second part the capability grouping system is explained. In the third part the capability units are described and the use, suitability, and management requirements for each are discussed. In the fourth part estimates of yields for suitable crops are given for each of the soils under high and medium levels of management.

General principles of soil management

Some principles of management are general enough to apply to all of the soils suitable for farm crops and pasture throughout the survey area, though the individual soils or groups of soils require different types of management. These general principles of management are discussed in the following paragraphs.

Many soils in the survey area need lime or fertilizer, or both. The amounts needed depend on the natural content of lime and plant nutrients, which can be determined by laboratory analyses of soil samples. Proper amounts also depend on the needs of the crop and on the level of yield desired. Only general suggestions for applications of lime and fertilizer are given in this survey.

Most of the soils in this survey area were never high in content of organic matter, and to build up the content to a high level generally is not practical. It is important, however, to return organic matter to the soil by adding farm manure, leaving plant residue on the surface, and growing sod crops, cover crops, and green-manure crops.

Tillage tends to break down soil structure. Tillage should be kept to the minimum necessary to prepare a seedbed and control weeds. Maintaining the organic-matter content of the plow layer also helps to protect the structure.

On wet soils, such as Stendal silt loam, production of cultivated crops can be increased by open-ditch drainage or by tile drainage. Tile drains are expensive to install, but they generally provide better drainage than open ditches. Soils that have a fragipan are difficult to drain; they can generally be drained better by open ditches than by tile. Open-ditch drainage is more effective if the ditches intercept the water as it moves horizontally on top of the fragipan. For drainage by either tile or open ditches, suitable outlets are needed.

All of the gently sloping and steeper soils that are cultivated are subject to erosion. Runoff and erosion occur mostly while a cultivated crop is growing or soon after one has been harvested. On erodible soils such as Tilsit silt loam, 2 to 6 percent slopes, a cropping system that controls runoff and erosion is needed in combination with other erosion-control practices. As used here, cropping system refers to the sequence of crops grown and management that includes minimum tillage, mulch planting, use of crop residue, growing of cover crops and green-manure crops, and use of lime and fertilizer. Other erosion-control practices are contour cultivation, terracing, contour stripcropping, diversion of runoff, and use of grassed waterways. The effectiveness of a particular combination of these practices differs from one soil to another, but different combinations can be equally effective on the same soil. The local representative of the Soil Conservation Service can assist in planning an effective combination of practices.

Pasture is effective in controlling erosion on all of the soils suitable for pasture. Good pasture management is needed to provide enough ground cover to keep the soil from eroding. Good pasture management provides for fertilization, control of grazing, selection of pasture mixtures, and other practices that are adequate for maintaining good ground cover and forage for grazing. Grazing is controlled by rotating the livestock from one pasture to another and by providing rest periods for the pasture after each grazing period to allow plants to regrow. It is important on some soils that pasture mixtures be selected that will require the least renovation to maintain good ground cover and forage.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most field crops. The groups are made according to limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not consider possible but unlikely major reclamation projects; and does not apply to horticultural crops, truck crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees, wildlife, watershed management, or engineering.

In the capability system, all types of soils are grouped at three levels: capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife (None in this survey area).

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes (None in this survey area).

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in this survey area, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-4. Thus, in one symbol, the Roman numeral designates the capability class or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units [3]

The capability units are described on the pages that follow. Suitable crops and management for the soils in each unit are suggested.

The names of soil series are included in the descriptions of the capability units, but this does not mean that all of the soils of a given series are in the unit. To find the names of all the soils in each unit, refer to the "Guide to Mapping Units" located at the end of this survey.

CAPABILITY UNIT I-1

This unit consists of nearly level soils of the Cuba and Pope series. These soils are on bottom lands. They are well drained and have a deep rooting zone. They have a silt loam or fine sandy loam surface layer and are easy to till. They have medium to high available water capacity. Permeability is moderate in Cuba soils and moderately rapid in Pope soils. Organic-matter content is medium. The soils are very strongly acid. The Pope soils are gravelly in some areas. Response of crops to lime and fertilizer is good. The hazard of flooding is slight. Flooding occurs mostly late in winter or early in spring.

The soils in this unit are well suited to all of the crops and pasture and hay plants common in the area. Examples of crops that grow well are corn, tobacco, and grasses and legumes such as Kentucky bluegrass, Kentucky 31 fescue, orchardgrass, alfalfa, red clover, Ladino clover, and annual lespedezas. Small grain planted in fall is subject to damage by overflow. These soils are also suited to trees and to other less intensive uses.

The general principles of good management that concern fertilization, maintenance of organic-matter content, and tillage practices are important in keeping these soils productive. Under high-level management row crops can be grown year after year.

CAPABILITY UNIT I-2

This unit consists of nearly level soils of the Chavies and Whitley series. These soils are on low stream terraces. They are well drained and have a deep rooting zone. They have a surface layer of silt loam or fine sandy loam and are easily tilled. They have high available water capacity. Permeability is moderate in Whitley soils and moderately rapid in Chavies soils. Organic-matter content is medium. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. The hazard of flooding is slight. Flooding is infrequent and occurs mostly late in winter and early in spring.

The soils in this unit are well suited to all row crops and pasture and hay plants common in the area. Examples of crops that grow well are corn, tobacco, small grain, and grasses and legumes such as Kentucky bluegrass, Kentucky 31 fescue, orchardgrass, alfalfa, red clover, Ladino clover, and annual lespedezas. These soils are also suited to trees and to other less intensive uses.

The general principles of good management that concern fertilization, maintenance of organic-matter content, and tillage practices are important in keeping these soils productive. Under high-level management row crops can be grown year after year.

CAPABILITY UNIT IIe-1

This unit consists of gently sloping soils of the Allegheny, Muse, and Whitley series. These soils are on stream terraces, toe slopes, and alluvial fans. They are well drained and have a deep rooting zone. They have a surface layer of silt loam or loam and are easy to till.

[3] Paul M. Love, soil scientist, Soil Conservation Service, assisted in the preparation of this section.

They have high available water capacity and moderate or moderately slow permeability. Organic-matter content is low to medium. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. If these soils are cultivated, the hazard of erosion is moderate.

The soils in this unit are well suited to all of the row crops and pasture and hay plants common in the area. Examples of crops that grow well are corn, tobacco, small grain, and grasses and legumes such as Kentucky 31 fescue, orchardgrass, alfalfa, red clover, Ladino clover, annual lespedezas, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

A suitable cropping system and erosion-control practices help to slow surface runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIe-2

This unit consists of gently sloping soils of the Monongahela and Tilsit series. These soils are on uplands and stream terraces. They are moderately well drained and have a fragipan at a depth of about 21 to 24 inches, which restricts root growth. The surface layer is silt loam or fine sandy loam and is easy to till. These soils have medium available water capacity and slow permeability. Organic-matter content is low. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. A seasonal high water table is at a depth of 1½ to 2 feet. If these soils are cultivated, the hazard of erosion is moderate.

The soils in this unit are suited to most of the row crops and pasture and hay plants common to the area. Alfalfa tends to die out after 2 or 3 years. Tobacco is sometimes damaged by excess water in the rooting zone, which is caused by the slow permeability of the fragipan. Corn and small grain grow well. Suitable grasses and legumes are Kentucky 31 fescue, orchardgrass, red clover, Ladino clover, annual lespedezas, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

A suitable cropping system and erosion control practices are needed to slow surface runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants (fig. 11).

CAPABILITY UNIT IIe-3

This unit consists of gently sloping soils of the Cranston, Renox, and Rigley series. These soils are on alluvial fans and toe slopes. They are well drained and have a deep rooting zone. The surface layer is gravelly silt loam and gravelly fine sandy loam. These soils are somewhat difficult to till, because they contain gravel. These soils have medium to high available water capacity and moderate to moderately rapid permeability. Organic-matter content is low to high. Reaction is very strongly acid to neutral. Response of crops to fertilizer is good. Lime is not generally needed on the Renox soil. The hazard of erosion is moderate if these soils are used for cultivated crops.

The soils in this unit are suited to most commonly grown row crops and to hay and pasture plants. Exam-

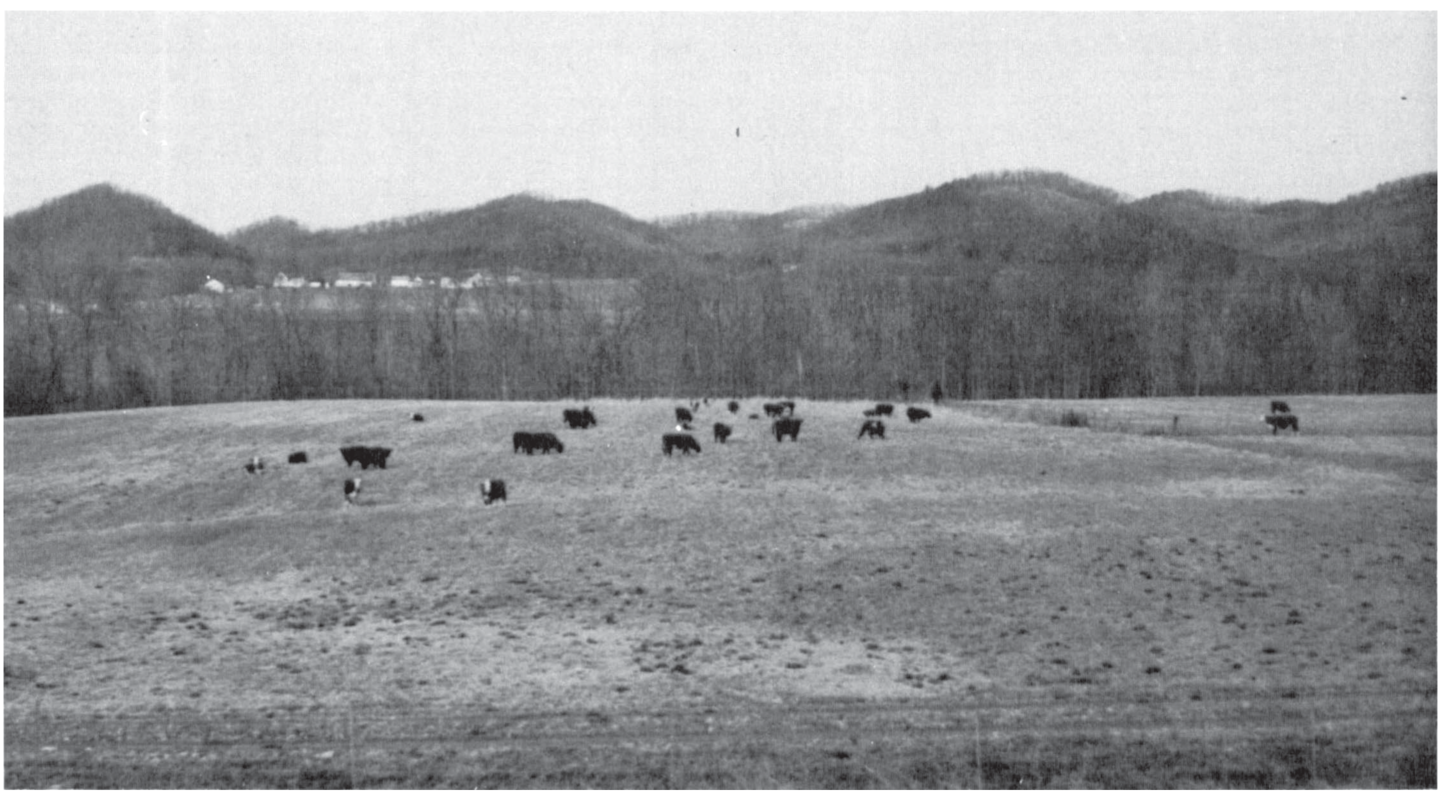

Figure 11.—**Pasture on a Tilsit silt loam.**

ples of plants that grow well are corn, tobacco, small grain, and grasses and legumes, including orchardgrass, Kentucky 31 fescue, timothy, alfalfa, red clover, Ladino clover, sericea lespedeza, and annual lespedezas. These soils are also suited to trees and to other less intensive uses.

If these soils are cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management provide a good plant cover.

CAPABILITY UNIT IIw-1

This unit consists of nearly level soils of the Stendal series. These soils are on flood plains. They are deep and are somewhat poorly drained. They have a surface layer of silt loam or fine sandy loam, and they are easy to till. These soils have high available water capacity and moderate or moderately rapid permeability. The effective depth for root growth is restricted by a seasonal high water table if these soils are not adequately drained. Organic-matter content is low. Reaction is very strongly acid to neutral. The seasonal high water table is at a depth of ½ to 1½ feet. Flooding is a hazard, but it occurs mostly late in winter and early in spring.

If these soils are adequately drained, tobacco and corn grow well year after year. Pasture and hay crops that withstand wetness, such as Kentucky 31 fescue, redtop, red clover, alsike clover, Ladino clover, Kobe lespedeza, and reed canarygrass, also grow well. These soils are also suited to trees and to other less intensive uses.

In addition to drainage, the general principles of management that concern fertilization, maintenance of organic-matter content, and tillage are important in keeping these soils productive.

CAPABILITY UNIT IIw-2

This unit consists of nearly level to gently sloping soils of the Cotaco and Morehead series. These soils are on broad, low terraces and alluvial fans. They are somewhat poorly drained to moderately well drained. The effective depth of root growth is restricted by the seasonal high water table for appreciable periods unless adequate drainage is provided. These soils have a surface layer of fine sandy loam or silt loam and are easy to till. They have high available water capacity and moderate permeability. Organic-matter content is low. Reaction is very strongly acid or neutral. Response of crops to fertilizer is good if the soils are adequately drained. The seasonal high water table is at a depth of 1 to 2 feet, and flooding is a slight hazard in some areas. The hazard of erosion is slight to moderate if these soils are used for cultivated crops.

If these soils are adequately drained, they are suited to tobacco, corn, and small grain. Pasture and hay plants that withstand wetness grow well on these soils. Among these plants are Kentucky 31 fescue, redtop, red clover, Ladino clover, alsike clover, Kobe lespedeza, and reed canarygrass. These soils are also suited to trees and to other less intensive uses.

If the gently sloping soils of this unit are cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. Except for the need for artificial drainage if the soils are cultivated, the general principles of management that concern fertilization, maintenance of organic matter, and tillage are important in keeping these soils productive.

CAPABILITY UNIT IIs-1

This unit consists of nearly level soils of the Clifty and Skidmore series. These soils are on flood plains. They are well drained. The rooting zone is generally restricted by a very gravelly substratum. The soils are gravelly in the subsoil or throughout the profile. Tillage is somewhat difficult in areas that have a gravelly surface layer. These soils have low to medium available water capacity and moderately rapid to moderate permeability. They are slightly droughty to droughty. Organic-matter content is low. Reaction is very strongly acid to slightly acid. Response of crops to fertilizer is fair to good. Flooding is a slight hazard and occurs mostly in winter and early in spring. The hazard of erosion is none to slight.

These soils are suited to most commonly grown row crops and hay and pasture plants. Corn and tobacco can be grown year after year. Some hay and pasture plants that are suited to the soils in this unit are orchardgrass, Kentucky 31 fescue, timothy, alfalfa, red clover, annual lespedezas, and sericea lespedeza. Small grain planted in the fall may be damaged by flooding. These soils are also suited to trees and to other less intensive uses. The main limitation of these soils is the high gravel content and the resulting droughtiness.

The general principles of good management that concern fertilization, maintenance of organic-matter content, and tillage are important in keeping these soils productive.

CAPABILITY UNIT IIIe-1

This unit consists of sloping soils of the Allegheny, Muse, and Whitley series. These soils are on stream terrace, toe slopes, and alluvial fans. Whitley soils are also on uplands. These soils are well drained and have a deep rooting zone. They have high available water capacity and moderate to moderately slow permeability. Organic-matter content is low to medium, and reaction is very strongly acid. Response of crops to lime and fertilizer is good. The hazard of erosion is severe if these soils are cultivated.

The soils in this unit are suited to all commonly grown row crops and hay and pasture plants. Examples of plants that grow well are corn, tobacco, small grain, and grasses and legumes, such as Kentucky 31 fescue, orchardgrass, alfalfa, timothy, red clover, Ladino clover, sericea lespedea, and annual lespedezas. These soils are also suited to trees and to other less intensive uses.

If these soils are cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIIe-2

Latham silt loam, 6 to 12 percent slopes, is the only soil in this unit. This soil is on uplands. It is moderately well drained and has a moderately deep rooting zone.

The surface layer is silt loam. This soil has medium available water capacity and slow permeability. Organic-matter content is low. Reaction is very strongly acid. The hazard of erosion is severe if this soil is cultivated.

This soil is suited to most of the row crops and pasture and hay plants that are common in the area, but corn, tobacco, and alfalfa grow well only under a high level of management. Some grasses and legumes that are suited to this soil are Kentucky 31 fescue, red clover, annual lespedezas, and sericea lespedeza.

If this soil is cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIIe-3

Tilsit silt loam, 6 to 12 percent slopes, is the only soil in this unit. This soil is mostly on broad ridgetops on uplands. It is moderately well drained. A fragipan at a depth of about 24 inches restricts root growth. The surface layer is silt loam. This soil has medium available water capacity and slow permeability. Organic-matter content is low. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. A seasonal high water table is at a depth of 1½ to 2 feet. The hazard of erosion is severe if this soil is cultivated.

This soil is suited to most of the row crops and pasture and hay plants that are common in the area. Alfalfa, however, tends to die out after 2 or 3 years. Tobacco is sometimes damaged by excess water in the rooting zone, which is caused by the slow permeability of the fragipan. Corn and small grain grow well. Suitable grasses and legumes are Kentucky 31 fescue, orchardgrass, red clover, Ladino clover, annual lespedezas, and sericea lespedeza. This soil is also suited to trees and to other less intensive uses.

If this soil is cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIIe-4

This unit consists of sloping soils of the Cranston, Renox, and Rigley series. These soils are on alluvial fans and toe slopes. They are well drained and have a deep rooting zone. The surface layer is gravelly and ranges from silt loam to fine sandy loam. These soils are somewhat difficult to till, because of the gravel content. They have high to medium available water capacity and moderate to moderately rapid permeability. Reaction is very strongly acid to neutral. Response of crops to fertilizer is good and lime generally is not needed on the Renox soil. If soils of this unit are cultivated, the hazard of erosion is severe.

The soils in this unit are suited to all commonly grown row crops and hay and pasture plants. Among plants that grow well are corn, tobacco, small grain, and such grasses and legumes as Kentucky 31 fescue, orchardgrass, alfalfa, red clover, annual lespedezas, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

If these soils are cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIIe-5

This unit consists of sloping soils of the Gilpin and Hartsells series. These soils are on uplands. They are well drained and have a moderately deep rooting zone. The surface layer is silt loam or fine sandy loam. These soils are easy to till. Hartsells soils contain more sand throughout the profile than Gilpin soils. The soils in this unit have medium available water capacity. Gilpin soils have moderate permeability, and Hartsells soils have moderately rapid permeability. Natural fertility and organic-matter content are low. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. The hazard of erosion is severe if these soils are cultivated.

These soils are suited to most commonly grown row crops and hay and pasture plants. Small grain grows well, but corn and tobacco do so only under a high level of management. Some grasses and legumes that are suited to these soils are orchardgrass, Kentucky 31 fescue, timothy, red clover, annual lespedezas, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

If these soils are cultivated, a cropping system and other management practices are needed to slow runoff and control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IIIw-1

Bonnie silt loam is the only soil in this unit. This nearly level soil is on flood plains. It is deep and poorly drained. The surface layer is silt loam. This soil has high available water capacity, and permeability is moderate. Organic-matter content is low. Reaction is very strongly acid. Response of crops to fertilizer is good if drainage is adequate. A seasonal high water table saturates this soil to within a few inches of the surface unless the soil is drained artificially. This soil is subject to flooding during the growing season, as well as in winter and spring.

If this soil is adequately drained, corn can be grown in the same area year after year. Tobacco and small grain do not generally grow well on this soil. Pasture and hay plants that withstand wetness are better suited. These include Kentucky 31 fescue, redtop, alsike clover, Ladino clover, Kobe lespedeza, and reed canarygrass. This soil is also suited to trees and to other less intensive uses.

In addition to adequate drainage, the general principles of management that concern fertilization, maintenance of organic-matter content, and tillage are important in keeping this soil productive.

CAPABILITY UNIT IIIw-2

Johnsburg silt loam is the only soil in this unit. This nearly level soil is on stream terraces and broad ridgetops. It is somewhat poorly drained, and root growth is restricted at a depth of about 15 inches by a fragipan. This soil has a surface layer of silt loam. It is easy to till when it is dry enough to support farm machinery. This soil has medium available water capacity and very slow permeability. Organic-matter content is low. Reaction is very strongly acid. This soil has a seasonal high water table at a depth of ½ to 1 foot. Where this soil is on stream terraces, it is sometimes flooded. Flooding is mostly late in winter or early in spring. If this soil is cultivated, the hazard of erosion is slight.

If adequate drainage is provided, which is difficult because of the fragipan, the soil is suited to corn and small grain. Tobacco generally does not grow well on this soil. This soil is better suited to pasture and hay plants that withstand wetness, such as Kentucky 31 fescue, redtop, alsike clover, Ladino clover, and Kobe lespedeza. It is also suited to trees and to other less intensive uses.

The general principles of management that concern fertilization, maintenance of organic-matter content, and tillage are important in keeping this soil productive.

CAPABILITY UNIT IVe-1

This unit consists mostly of strongly sloping soils of the Allegheny, Cranston, Donahue, Muse, Rigley, and Whitley series. These soils are on toe slopes, stream terraces, and uplands. The soils are well drained. Donahue soils are moderately deep, and the rest are deep. Cranston and Rigley soils are somewhat difficult to till, because they are gravelly. The soils generally have high available water capacity, but the Cranston and Donahue soils have medium available water capacity. The soils in this unit have moderately slow to moderately rapid permeability. Organic-matter content is low to medium. Reaction is very strongly acid. Response of crops to lime and fertilizer is good. The hazard of erosion is very severe if these soils are cultivated.

These soils are suited to most of the commonly grown row crops. Because of the risk of damage by erosion if cultivated, the soils are better suited to pasture and hay, but they can be cultivated occasionally. Some of the grasses and legumes that are suited to these soils are Kentucky 31 fescue, orchardgrass, timothy, alfalfa, red clover, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

Because of the hazard of erosion, cropping systems and other management practices must provide adequate control of erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IVe-2

This unit consists of strongly sloping soils of the Gilpin and Hartsells series. These soils are on uplands. The soils are well drained and have a moderately deep rooting zone. The surface layer is silt loam or fine sandy loam. Hartsells soils contain more sand throughout the profile than Gilpin soils. The soils have medium available water capacity. Gilpin soils have moderate permeability, and Hartsells soils have moderately rapid permeability. Organic-matter content is low. These soils are very strongly acid. Response of crops to lime and fertilizer is good. The hazard of erosion is very severe if these soils are cultivated.

These soils are suited to most of the commonly grown row crops. Because of the hazard of erosion, the soils are better suited to pasture and hay than to cultivated crops; they can be cultivated occasionally if a high level of management is used. Some of the grasses and legumes that are suited to these soils are Kentucky 31 fescue, timothy, red clover, and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

Because of the hazard of erosion, cropping systems and other management practices are needed to control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IVe-3

This unit consists of strongly sloping soils of the Latham and Shelocta series. These soils are on uplands. They are well drained or moderately well drained. The Latham soils are moderately deep, and the Shelocta soil is deep. The surface layer is silt loam. The Latham soils have a clayey subsoil, and the Shelocta soil has a loamy subsoil. The Latham soils have medium available water capacity, and the Shelocta soil has high available water capacity. The Latham soils have slow permeability, and the Shelocta soil has moderate permeability. Organic-matter content is low. These soils are very strongly acid. Response of crops to lime and fertilizer is good. The hazard of erosion is very severe if these soils are cultivated.

These soils are suited to most commonly grown row crops. Corn, tobacco, and alfalfa do well only under a high level of management. Because of the risk of damage by erosion if these soils are cultivated, these soils are better suited to pasture and hay than to row crops; however, they can be cultivated occasionally. Some of the grasses and legumes that are suited to these soils are Kentucky 31 fescue, red clover, and sericea lespedeza. These soils are also suited to trees and other less intensive uses.

Because of the hazard of erosion, cropping systems and other management practices are needed to control erosion. It is important that pasture management include controlled grazing, fertilization, and other practices that assure vigorous pasture plants.

CAPABILITY UNIT IVw-1

Mullins silt loam is the only soil in this unit. This nearly level soil is on stream terraces and broad ridgetops. It is poorly drained, and root growth is restricted at a depth of about 16 inches by a fragipan. This soil has a surface layer of silt loam. It has medium available water capacity and very slow permeability. Organic-matter content is low. Reaction is very strongly acid. A seasonal high water table is above a depth of ½ foot. On stream terraces this soil sometimes is flooded, mostly late in winter and early in spring.

The seasonal high water table limits the use of this soil for cultivated crops. This soil is suited to pasture and hay plants that withstand wetness, including Ken-

tucky 31 fescue, redtop, alsike clover, Ladino clover, and Kobe lespedeza. This soil is also suited to trees and to other less intensive uses.

In addition to artificial drainage, the general principles of management that apply to fertilization, maintenance of organic-matter content, and tillage are important in keeping this soil productive.

CAPABILITY UNIT VIe-1

This unit consists of moderately steep soils of the Cranston and Rigley series. These soil are on side slopes and toe slopes on uplands. They are well drained and have a deep rooting zone. The surface layer is gravelly silt loam or gravelly fine sandy loam. These soils have medium to high available water capacity and moderately rapid permeability. Organic-matter content is low. Reaction is very strongly acid. Response of plants to fertilizer and lime is good.

These soils are not suited to cultivation, because the risk of erosion is too great. They are, however, suited to most commonly grown hay and pasture plants. Some of the grasses and legumes suited to these soils are Kentucky 31 fescue, orchardgrass, timothy, redtop, and sericea lespedeza. These soils are well suited to trees and to other less intensive uses.

It is important to keep a good plant cover on these soils. Grass and legume mixtures should be selected that require renovation least frequently. Periods of rest from grazing are needed to allow pasture plants to recover.

CAPABILITY UNIT VIe-2

This unit consists of moderately steep soils of the Latham, Muse, and Shelocta series. These soils are on uplands and colluvial side slopes. The soils are well drained or moderately well drained. Muse and Shelocta soils have a deep rooting zone, and Latham soils have a moderately deep rooting zone. The soils in this unit have a surface layer of silt loam. Muse and Shelocta soils have high available water capacity, and Latham soils have medium available water capacity. Permeability is slow to moderate. Organic-matter content is low. Reaction is very strongly acid. Response of plants to lime and fertilizer is good.

These soils are not suited to cultivation, because the hazard of erosion is too severe. They are suited to pasture, and some of the better suited grasses and legumes are Kentucky 31 fescue and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

Good plant cover on these soils is important to slow runoff and control erosion. Periods of rest from grazing are needed to allow pasture plants to regrow.

CAPABILITY UNIT VIs-1

This unit consists of sloping to strongly sloping soils of the Donahue, Ramsey, and Steinsburg series. These soils are on uplands. The Donahue and Steinsburg soils are well drained, and the Ramsey soil is somewhat excessively drained. The Donahue and Steinsburg soils have a moderately deep rooting zone, and the Ramsey soil has a shallow rooting zone. The soils in this unit are rocky. The Ramsey and Steinsburg soils have a loamy subsoil, and the Donahue soil has a clayey subsoil. The Ramsey and Steinsburg soils have low to very low available water capacity, and the Donahue soil has medium available water capacity. The Ramey soil has rapid permeability, the Steinsburg soil has moderately rapid permeability, and the Donahue soil has moderately slow permeability. Organic-matter content is low. Reaction is very strongly acid in the Steinsburg and Ramsey soils and medium acid in the Donahue soil.

These soils are not suited to cultivation, because rock outcrops are on the surface. The soils are better suited to pasture than to most other uses, but some areas can be used for hay if rocks do not prevent this. Suitable plants are Kentucky 31 fescue and sericea lespedeza. These soils are also suited to trees and to other less intensive uses.

It is important to keep a good plant cover on these soils. Grass and legume mixtures should be selected that require renovation least frequently. Periods of rest from grazing are needed to allow pasture plants to regrow.

CAPABILITY UNIT VIIe-1

This unit consists of steep to very steep soils of the Berks, Cranston, Latham, and Shelocta series. These soils are on uplands and colluvial side slopes. The soils are well drained or moderately well drained. The Cranston and Shelocta soils have a deep rooting zone, and the Berks and Latham soils have a moderately deep rooting zone. The soils in this unit have low to high available water capacity and slow to moderately rapid permeability. Organic-matter content is low. Reaction is very strongly acid.

These soils are not suited to cultivation, because they are too steep and because the hazard of erosion is too severe. Most areas are too steep for the use of modern machinery. Woodland and wildlife habitat are suitable uses. Pasture stands are difficult to establish and maintain, and the renovation of pasture is difficult because of the problems in using farm machinery on the steep slopes. If the soils are used for pasture, grasses and legumes should be selected that produce a good plant cover and require renovation least frequently.

CAPABILITY UNIT VIIs-1

This unit consists of moderately steep to very steep soils of the Brookside, Donahue, Muse, Ramsey, Rigley, Steinsburg, and Trappist series. These soils are on uplands and colluvial slopes. The Ramsey soil is somewhat excessively drained, and the rest are well drained. The Brookside, Muse, and Rigley soils are deep; the Donahue, Trappist, and Steinsburg soils are moderately deep; and the Ramsey soil is shallow.

These soils are too stony or rocky and too steep to be cultivated. Some of the moderately steep soils are suited to pasture, but mowing and renovation are difficult because of the stones and rock outcrops on the surface and because of the steepness. This unit is better suited to woodland and wildlife habitat than to most other uses. Most of the acreage is wooded.

Estimated yields

The estimated average yields for the most common crops grown under two levels of management are given in table 3. Yields obtained under a medium level of management are in columns A, and yields under a high level of management are in columns B.

Yields given are averages that may be expected over a period of several years. Yields for any one year may be adversely affected by extremes of weather, insects, disease, or some other factor or may be high because of a favorable combination of factors.

Comparison of yields in columns A and columns B show increases that can be expected as a result of improved management. No yields under a medium level of management are given for tobacco, because a high level of management is almost always used for that crop.

A high level of management requires (1) using adapted recommended varieties; (2) seeding at the proper rate, inoculating legumes, planting at the proper time, and harvesting efficiently; (3) controlling weeds, insects, and plant disease; (4) applying fertilizer at a rate equal to or above the current recommendations of the University of Kentucky Agricultural Experiment Station, or equal to or above the need shown by properly interpreted soil tests; (5) using enough lime; (6) draining naturally wet soils wherever feasible; (7) using cropping systems that control erosion and maintain soil structure, tilth, and organic-matter content; (8) controlling erosion by such practices as minimum tillage, interseeding of winter crops in row crops, contour tillage, terracing, contour stripcropping, and sodding of waterways; (9) using cover crops, crop residue, or both, to increase the supply of organic matter and to control erosion; (10) using all applicable pasture-management practices; and (11) using other practices that may be suggested by representatives of the Soil Conservation Service and the Agricultural Extension Service in these counties.

A high level of management is not considered to be the maximum level. Rather, it is one that many farmers will find practical to reach. This level is also one that results in the highest sustained production that is economically feasible.

A medium level of management requires fertilization, treatment, and other management practices that are generally considered to be the minimum necessary to keep the soil from deteriorating and to produce crops that yield a profit.

TABLE 3.—*Estimated yields per acre of the principal crops under two levels of management*

[Yields in columns A are those expected under a medium level of management; those in columns B under a high level of management. Dashes indicate that the soil is considered unsuitable for the crop or the crop is not commonly grown on the soil]

Soil	Corn		Tobacco	Wheat		Hay: Alfalfa and grass		Hay: Red clover and grass [1]		Lespedeza (Korean or Kobe)		Pasture [2]	
	A	B	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Lbs*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Allegheny loam, 2 to 6 percent slopes	70	100	2, 900	25	40	3. 0	4. 1	1. 7	2. 8	1. 0	1. 8	150	230
Allegheny loam, 6 to 12 percent slopes	60	90	2, 500	20	40	3. 0	4. 0	1. 7	2. 8	. 8	1. 6	145	230
Allegheny loam, 12 to 20 percent slopes	45	75	2, 250	15	30	2. 5	3. 5	1. 0	2. 0	---	---	125	200
Berks silt loam, 40 to 70 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Bonnie silt loam	---	85	---	---	---	---	---	---	2. 0	1. 0	2. 0	125	200
Brookside stony silt loam, 30 to 60 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Chavies fine sandy loam, acid variant, 0 to 6 percent slopes	80	115	3, 000	30	45	3. 5	4. 5	2. 0	2. 9	1. 2	2. 0	180	260
Clifty silt loam	55	85	2, 400	20	30	2. 5	3. 5	1. 3	2. 2	. 7	1. 5	125	200
Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes	70	100	2, 400	20	35	---	---	1. 5	2. 6	1. 0	2. 0	135	220
Cranston gravelly silt loam, 2 to 6 percent slopes	65	95	2, 800	25	40	3. 0	4. 0	1. 5	2. 8	1. 0	1. 8	150	230
Cranston gravelly silt loam, 6 to 12 percent slopes	55	85	2, 500	20	35	2. 5	3. 5	1. 5	2. 4	. 8	1. 6	120	200
Cranston gravelly silt loam, 12 to 20 percent slopes	40	70	---	15	30	2. 0	3. 5	1. 0	2. 0	---	---	115	200
Cranston gravelly silt loam, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	100	170
Cranston gravelly silt loam, 30 to 60 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Cuba silt loam	85	120	3, 200	35	50	4. 0	5. 0	2. 0	3. 2	1. 3	2. 3	200	285
Donahue rocky sandy loam, 6 to 20 percent slopes	---	---	---	---	---	---	---	---	---	---	---	110	180
Donahue rocky sandy loam, 20 to 40 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Gilpin silt loam, 6 to 12 percent slopes	50	80	2, 100	20	35	2. 0	3. 5	1. 1	2. 1	. 8	1. 5	125	200
Gilpin silt loam, 12 to 20 percent slopes	35	60	1, 500	---	---	---	3. 0	1. 0	2. 0	---	---	100	170
Hartsells fine sandy loam, 6 to 12 percent slopes	50	85	2, 200	20	35	2. 5	3. 5	1. 0	2. 0	. 7	1. 5	100	200
Hartsells fine sandy loam, 12 to 20 percent slopes	35	65	1, 500	15	25	2. 0	3. 0	. 8	1. 8	---	---	90	170
Johnsburg silt loam	40	80	1, 500	15	25	---	---	1. 0	1. 8	1. 3	2. 0	125	200

TABLE 3.—*Estimated yields per acre of the principal crops under two levels of management*—Continued

Soil	Corn		Tobacco	Wheat		Hay: Alfalfa and grass		Hay: Red clover and grass [1]		Lespedeza (Korean or Kobe)		Pasture [2]	
	A	B	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Lbs*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Latham silt loam, 6 to 12 percent slopes	45	80	2, 200	20	30	---	3. 0	1. 3	2. 3	. 8	1. 5	100	170
Latham silt loam, 12 to 20 percent slopes	35	65	2, 100	15	25	---	2. 5	1. 0	2. 0	---	---	80	150
Latham silt loam, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	60	130
Latham-Shelocta silt loams, 12 to 20 percent slopes	40	70	2, 100	---	30	---	3. 0	---	2. 0	---	---	80	150
Latham-Shelocta silt loams, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	65	130
Latham-Shelocta silt loams, 30 to 50 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Monongahela fine sandy loam, 2 to 6 percent slopes	55	90	2, 500	20	40	2. 0	3. 0	1. 7	2. 6	1. 0	1. 7	125	200
Morehead silt loam	70	100	2, 400	20	35	---	---	1. 4	2. 6	1. 2	2. 1	175	235
Mullins silt loam	---	60	---	---	---	---	---	---	2. 0	---	1. 5	100	170
Muse silt loam, 2 to 6 percent slopes	65	100	2, 700	25	45	3. 0	4. 0	1. 8	2. 8	1. 0	2. 0	150	230
Muse silt loam, 6 to 12 percent slopes	60	90	2, 600	25	40	3. 0	4. 0	1. 8	2. 8	1. 0	1. 9	140	230
Muse silt loam, 12 to 20 percent slopes	45	70	2, 200	20	35	2. 0	3. 5	1. 4	2. 4	---	---	100	200
Muse silt loam, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	80	160
Muse-Trappist stony silt loams, 30 to 60 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Pope fine sandy loam	80	110	3, 000	30	45	3. 5	4. 5	1. 8	3. 0	1. 2	2. 2	175	250
Pope gravelly fine sandy loam	65	95	2, 700	25	40	3. 0	4. 0	1. 5	2. 8	1. 0	2. 0	150	230
Renox gravelly fine sandy loam, 2 to 6 percent slopes	75	105	2, 900	30	45	3. 5	4. 5	2. 0	3. 0	1. 2	2. 0	170	250
Renox gravelly fine sandy loam, 6 to 15 percent slopes	70	95	2, 700	25	40	3. 0	4. 0	1. 8	2. 8	1. 0	1. 8	150	230
Rigley gravelly fine sandy loam, 2 to 6 percent slopes	70	100	2, 900	25	40	3. 0	4. 1	1. 7	2. 8	1. 0	1. 8	150	230
Rigley gravelly fine sandy loam, 6 to 12 percent slopes	65	90	2, 500	20	35	3. 0	4. 0	1. 5	2. 8	. 8	1. 6	145	230
Rigley gravelly fine sandy loam, 12 to 20 percent slopes	50	80	2, 000	15	30	2. 5	3. 5	1. 0	2. 3	---	---	125	200
Rigley gravelly fine sandy loam, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	100	175
Rigley stony fine sandy loam, 30 to 60 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Rigley-Donahue complex, 6 to 20 percent slopes	45	75	2, 000	---	30	2. 5	3. 5	1. 0	2. 2	---	---	100	115
Rigley-Donahue complex, 20 to 30 percent slopes	---	---	---	---	---	---	---	---	---	---	---	55	115
Rigley-Donahue complex, 30 to 60 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	---
Skidmore gravelly fine sandy loam	60	90	2, 500	20	30	2. 5	3. 5	1. 5	2. 5	. 8	1. 6	125	200
Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes	---	---	---	---	---	---	---	---	---	---	---	65	125
Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes	---	---	---	---	---	---	---	---	---	---	---	---	100
Stendal silt loam	65	100	2, 400	---	35	---	---	1. 8	2. 8	1. 0	2. 0	175	235
Stendal fine sandy loam, neutral variant	65	100	2, 300	---	35	---	---	1. 5	2. 8	1. 2	2. 0	170	225
Strip mines	---	---	---	---	---	---	---	---	---	---	---	---	---
Tilsit silt loam, 2 to 6 percent slopes	60	90	2, 500	20	40	2. 0	3. 0	1. 7	2. 6	1. 0	1. 7	125	200
Tilsit silt loam, 6 to 12 percent slopes	50	80	2, 200	18	35	---	2. 5	1. 6	2. 3	1. 0	1. 6	110	190
Whitley silt loam, 6 to 12 percent slopes	60	90	2, 400	25	40	2. 7	4. 0	1. 7	2. 8	1. 0	1. 8	135	230
Whitley silt loam, 12 to 20 percent slopes	40	70	2, 000	15	30	2. 0	3. 5	1. 2	2. 3	---	---	100	200
Whitley silt loam, terrace, 0 to 2 percent slopes	80	115	3, 200	30	45	3. 5	5. 0	2. 0	3. 0	1. 3	2. 0	180	285
Whitley silt loam, terrace, 2 to 6 percent slopes	70	105	3, 000	30	45	3. 5	5. 0	2. 0	3. 0	1. 3	2. 0	180	285
Whitley silt loam, terrace, 6 to 12 percent slopes	65	95	2, 500	25	40	3. 0	4. 5	1. 7	2. 8	1. 1	1. 8	150	255

[1] Yields are those expected in the second year.

[2] Estimated yields are for tall fescue and a legume such as sericea lespedeza.

[3] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture can be grazed during a single grazing season without damage to the pasture. An acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

The failure to adequately apply one or more of the practices listed for a high level of management may cause production to drop to an unprofitable level and may result in some permanent damage to the soil. Inadequate drainage or only partial application of practices that control runoff and erosion are examples of deficiencies that relate to a medium level of management.

Use of the Soils for Wildlife

This section contains information on the types of wildlife in Menifee and Rowan Counties and Northwestern Morgan County and on the suitability of the soils for producing the food and cover plants needed by this wildlife.

White-tailed deer, ruffed grouse, gray squirrel, fox squirrel, cottontail rabbit, bobwhite quail, and wild turkey are the most common animals in the survey area. Habitat for white-tailed deer and wild turkey is especially good in the Daniel Boone National Forest.

Successful management of wildlife on any tract of land requires, among other factors, that food, cover, and water be available in a suitable combination. Lack of any one of these necessities, unfavorable balance between them, or inadequate distribution of them may severely limit or cause the absence of desired wildlife species. Information on soils provides a valuable tool in creating, improving, or maintaining suitable food, cover, and water for wildlife.

Most wildlife habitats are managed by planting suitable vegetation or by manipulating existing vegetation so as to bring about natural establishment, increase, or improvement of desired plants, or by combinations of such measures. The influence of a soil on the growth of plants is known for many species and can be inferred for others from a knowledge about the characteristics and behavior of the soil. In addition, water areas can be created or natural ones improved as wildlife habitat. Information on soils is useful for these purposes.

Soil interpretations for wildlife habitat serve a variety of purposes. They aid in selecting the more suitable sites for various types of habitat management. They indicate the intensity of management needed to achieve satisfactory results. They also show why it may not be generally feasible to manage a particular area for a given type of wildlife.

These interpretations also may serve in broad-scale planning of wildlife management areas, parks, and natural areas or in acquiring wildlife lands. By means of map overlays, individual habitat element suitabilities or groupings may be made.

The soil areas shown on the soil survey maps are rated without regard to positional relationships with adjoining delineated areas. The size, shape, or location of the outlined areas do not affect the rating. Certain influences on habitat, such as elevation and aspect, must be appraised onsite.

The soils in the survey area have been placed in wildlife groups according to their suitability for the establishment or construction and management of the elements of habitat important to wildlife. Each group contains soils that potentially will (1) produce similar types of food and cover crops with similar treatment and (2) have similar capabilities and limitations in the establishment or construction and management of the wildlife habitat elements. The "Guide to Mapping Units" shows the wildlife group for each of the soils in this survey area.

The main factors considered in placing each soil in a wildlife group are (1) potential productivity of different crops planted in clearings, (2) production of different types of food and cover plants that commonly are established by natural processes, and (3) the potential suitability of the soils for different kinds of wildlife.

In table 4, the soils in the survey area are rated for their relative suitability for the creation, improvement, or maintenance of seven elements of wildlife habitat and for three main kinds of wildlife. These ratings are based upon limitations imposed by the characteristics or behavior of the soils. Three levels of suitability are recognized. It also is recognized that certain conditions render a site unsuited to a particular habitat element. Definitive ratings in the table indicate the degree of soil suitability for a given habitat element. They also indicate the relative extent of soil limitation.

The ratings given in table 4 are well suited, suited, poorly suited, and unsuited. A rating of *well suited* means that soil limitations are negligible in the management of the designated habitat element. Generally, the intensity of management required for the creation, improvement, or maintenance of the habitat element is low and satisfactory results are well assured. A rating of *suited* means that soil limitations moderately affect the management of the designated habitat element. Fairly frequent attention and a moderate intensity of effort are required to achieve satisfactory results. A rating of *poorly suited* means that soil limitations are severe. The creation, improvement, or maintenance of the designated habitat element is difficult, may be expensive, and requires intensive effort to attain satisfactory results. A rating of *unsuited* means that soil limitations are so extreme that it is highly impractical, if not impossible, to manage the designated habitat element.

The seven wildlife habitat elements rated in table 4 are defined in the following paragraphs.

Grain and seed crops are grains or seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghums, wheat, oats, millet, buckwheat, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife food and cover. Examples are fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and panicgrasses.

Wild herbaceous upland plants are native or introduced perennial grasses and forbs (weeds) that provide food and cover, principally to upland wildlife, and that are established mainly by natural processes. Examples are bluestem, indiangrass, wheatgrass, wild ryegrass, oatgrass, pokeweed, strawberries, lespedeza, beggardweed, wild beans, nightshade, goldenrod, and dandelion.

Hardwood woody plants are nonconiferous trees, shrubs, and woody vines that produce friuts, nuts, buds,

TABLE 4.—*Suitability of the soils for*

[Strip mines (Sx)

Wildlife groups and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Group 1: Gently sloping and sloping, moderately well drained to well drained soils on fans, terraces, and ridgetops. AlB, AlC, CrB, CrC, GlC, HaC, LaC, MoB, MsB, MsC, ReB, ReC, RgB, RgC, TlB, TlC, WhC, WtB, WtC.	Suited	Well suited	Well suited
Group 2: Strongly sloping, dominantly well drained soils on toe slopes and ridgetops. AlD, CrD, GlD, HaD, LaD, LsD, MsD, RgD, RoD, WhD.	Poorly suited	Suited	Well suited
Group 3: Moderately steep to very steep, dominantly well drained soils on mountainsides. BrF, CrE, CrF, LaE, LsE, LsF, MsE, MtF, RgE, RlF, RoE, RoF.	Unsuited	Suited to poorly suited.	Well suited
Group 4: Dominantly sloping to steep, well-drained, rocky soils and shallow, somewhat excessively drained and well-drained, moderately deep soils on mountainsides. BeF, SrD, SrF.	Poorly suited to unsuited.	Suited to poorly suited.	Suited to poorly suited.
Group 5: Dominantly strongly sloping to steep, well-drained, rocky soils on upper slopes. DoD, DoF.	Unsuited	Poorly suited	Well suited
Group 6: Nearly level, poorly drained soils on flood plains and terraces. These soils are subject to flooding in most places. Bo, Mr.	Poorly suited	Suited	Suited
Group 7: Nearly level to gently sloping, somewhat poorly drained to moderately well drained soils on fans, low terraces, and flood plains. These soils are subject to flooding in some areas. CoB, Jo, Mp, St, Sv.	Suited	Suited	Well suited
Group 8: Nearly level, well-drained soils on flood plains and low terraces. ChB, Ck, Cu, Po, Pp, Sd, WtA.	Well suited	Well suited	Well suited

catkins, twigs (browse), or foliage used extensively as food by wildlife and that commonly are established by natural processes but also may be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, maple, birch, poplar, grapes, honeysuckle, blueberry, briers, greenbriers, autumn-olive, and multiflora rose.

Coniferous woody plants are cone-bearing trees and shrubs that are important to wildlife mainly as cover but that also may furnish food in the form of browse, seeds, or fruitlike cones. Plants commonly are established by natural processes, but they also can be planted. Examples of such plant species are pine, hemlock, and redcedar.

There is a considerable evidence that, under situations of slow growth and delayed canopy closure, coniferous habitats harbor larger numbers and varieties of wildlife than under opposite growth conditions. Soil properties that tend to promote a rapid growth rate and canopy closure are therefore classed as limitations to the use and management of a soil for wildlife. In general, soil conditions favorable to quick establishment of conifers and their rapid growth require more intensive management to achieve satisfactory results for long-term use for wildlife. Soils rated as poorly suited for coniferous woody plants may provide easy establishment and temporary or short-term value for wildlife habitat.

Wetland food and cover plants are annual and perennial, wild herbaceous plants on moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively used by wetland wildlife. Examples are smartweed, wild millet, bulrush, spike sedge, rushes, sedges, burreeds, wildrice, rice cutgrass, mannagrass, and cattails.

Shallow water developments are impoundments or excavations for control of water, generally not more than 6 feet deep. Examples are low dikes and levees, shallow dugouts, level ditches, and devices for water-level control in marshy drainageways or channels.

The kinds of wildlife rated in table 4 are briefly described in the following paragraphs.

Open-land wildlife includes quail, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of cropland, pasture, meadow, and lawns and in areas overgrown by grasses, herbs, and shrubs.

Woodland wildlife includes ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray squirrel, gray fox, white-tailed deer, raccoon, wild turkey, and other birds and mammals that prefer woodland. They obtain food and cover in stands of hardwoods, coniferous trees, or shrubs, or a mixture of these plants.

elements of wildlife habitat and kinds of wildlife

were not rated]

Wildlife habitat elements—Continued				Kinds of wildlife		
Hardwood woody palnts	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Open-land	Woodland	Wetland
Well suited	Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Well suited	Poorly suited	Unsuited	Unsuited	Suited	Suited	Unsuited.
Well suited	Poorly suited	Unsuited	Unsuited	Suited	Suited	Unsuited.
Suited to poorly suited.	Suited to well suited.	Unsuited	Unsuited	Suited to unsuited.	Suited to poorly suited.	Unsuited.
Suited	Suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Well suited to suited.	Suited	Suited	Suited	Suited	Suited	Suited.
Well suited	Poorly suited	Poorly suited to suited.	Suited	Well suited	Suited	Suited.
Well suited	Poorly suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.

Wetland wildlife includes ducks, geese, herons, shore birds, mink, beaver, muskrat, and other birds and mammals that normally make their home in wet areas, such as ponds, marshes, and swamps.

Each rating under "Kinds of wildlife" in table 4 is based on the ratings listed for the habitat elements in the first part of the table. For open-land wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings shown for grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants and shallow water developments.

Engineering Uses of the Soils [4]

This section is useful to those who need information about soils used as structural material or as a foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in varying degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for low buildings, irrigation systems, ponds and small dams, and systems for sewage disposal.

Information in this section can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternative routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the soils on which they are built, for the purpose of predicting per-

[4] EMMETT M. BOLAND, civil engineer, Soil Conservation Service, assisted in the preparation of this section.

formance of structures on the same or similar soils in other locations.

6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Much of the information in this section is presented in tables. Only the data in table 5 are from the actual laboratory tests. Estimates of soil properties significant in engineering are given in table 6, and interpretations of engineering properties are given in table 7. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in the tables.

TABLE 5.—*Engineering*

[Tests made by Division of Research, Kentucky Department of Highways, Lexington, in accordance

Soil name and location	Parent material	Depth from surface	Moisture-density relationship [1]		California bearing ratio [2]	
			Maximum dry density	Optimum moisture content	Un-soaked	Soaked
		In	*Lb/ft*^{3}	*Pct*		
Berks silt loam: On Scott Branch, 1 mile NE. of Cogswell on Forest Service Road 16, Rowan County. (Modal profile.) Sample No. S67Ky103-11.	Acid siltstone residuum.	13–26	113	13	99	46
Brookside stony silt loam: Near Paragon, ½ mile N. of Poppin Rock Tunnel on State Route 519, Rowan County. (Modal profile.) Sample No. S67Ky103-12.	Shale, limestone, and sandstone colluvium.	24–35	103	20	17	4
		42–60	109	18	13	5
Cranston gravelly silt loam: Three miles north of Poppin Rock Tunnel at Paragon on State Route 519, and 300 yards east in a ravine, Rowan County. (Modal profile.) Sample No. S67Ky103-1.	Acid siltstone colluvium.	23–31	115	15	56	41
		38–50	117	14	92	31
Donahue sandy loam: Three miles S. of State Route 519 on State Route 1274, Rowan County. (Modal profile.) Sample No. S67Ky103-16.	Limestone.	13–25	93	27	--------	--------
Rigley stony fine sandy loam: About 1 mile S. of Forest Service Road 956 on Forest Service Road 951 and then ¼ mile E. on farm road, Rowan County. (Modal profile.) Sample No. S67-Ky103-15.	Sandstone and shale colluvium.	24–38	113	16	15	17
		63–78	105	17	61	3
Shelocta silt loam: About 4 miles SE. of the North Fork of the Licking River on State Route 1378 and then 200 yards N., Morgan County. (Modal profile.) Sample No. S67Ky 88-8.	Shale and siltstone colluvium over shale residuum.	26–36	105	20	34	6
		47–64	97	25	36	3
Tilsit silt loam: On State Route 801, 5½ miles S. of Farmers, Rowan County. (Modal profile.) Sample No. S67Ky103-10.	Siltstone residuum.	21–35	109	18	60	12
		56–71	109	18	54	5

[1] Based on AASHO Designation T 99-57, Method A (*1*).

[2] Based on methods described in "Investigation of Field and Laboratory Methods for Evaluating Subgrade Support in the Design of Highway Flexible Pavements," Engineering Experiment Station Bulletin 13, University of Kentucky, September, 1949.

[3] Mechanical analyses according to AASHO Designation T 88-57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially those that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have a special meaning to soil scientists and a different meaning to engineers. The Glossary defines many of these terms according to their meaning in soil science.

test data

with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [3]											Liquid limit	Plasticity index	Classification		Specific gravity [6]
Percentage passing sieve—							Percentage smaller than— [4]								
1½ in	¾ in	⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHO [5]	Unified	
											Pct				
98	79	65	58	49	43	40	27	18	6	3	([7])	([7])	A-4(1)	GM	2. 77
100	99	96	95	92	88	71	66	59	45	42	45	20	A-7-6(12)	CL-ML	2. 72
100	96	93	91	90	86	65	57	49	39	34	39	18	A-6(9)	CL	2. 75
100	95	86	80	73	63	56	45	34	16	9	([7])	([7])	A-4(4)	ML	2. 69
100	95	81	70	58	50	45	34	24	14	10	25	5	A-4(2)	GM-GC	2. 73
------	100	99	99	98	96	84	80	71	50	38	60	27	A-7-5(19)	MH	2. 75
99	98	97	96	90	85	57	44	37	23	18	28	12	A-6(5)	CL	2. 72
100	99	96	87	73	68	57	54	50	35	26	42	17	A-7-6(7)	CL-ML	2. 77
------	100	99	97	90	86	80	71	59	35	25	36	12	A-6(9)	CL-ML	2. 75
------	100	99	98	95	92	89	83	76	62	51	55	23	A-7-5(16)	MH	2. 81
100	99	97	94	93	92	90	74	55	34	26	([7])	([7])	A-4(8)	ML	2. 72
------	100	99	99	99	98	96	76	58	29	20	([7])	([7])	A-4(8)	ML	2. 71

material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soils.

[4] Based on material 3 inches or less in size.

[5] Based on AASHO Designation M 145-49 (*1*).

[6] Based on AASHO Designation T 100-60 (*1*).

[7] Nonplastic.

TABLE 6.—*Estimates of soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table.

Soil series and map symbols	Depth to bedrock	Depth to seasonal high water table	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Allegheny: AlB, AlC, AlD	6+	6+	0–18	Loam	SM or ML	A-4
			18–40	Sandy clay loam or clay loam.	SC or ML-CL	A-4 or A-6
			40–90	Loam or fine sandy loam.	SM or ML	A-2 or A-4
Berks: BeF	1½–3	6+	0–11	Silt loam or shaly silt loam.	ML or GM	A-4
			11–32	Shaly silt loam	GM or GP-GM	A-2, A-1, or A-4
Bonnie: Bo	6+	[1] 0–½	0–75	Silt loam	ML	A-4
Brookside: BrF	5+	6+	0–7	Silt loam	ML	A-4
			7–24	Silty clay loam	CL or ML-CL	A-6 or A-7
			24–60	Silty clay or heavy clay loam.	CH, CL or CL-ML	A-6 or A-7
Chavies, acid variant: ChB	6+	[1] 4+	0–34	Fine sandy loam	SM or ML	A-2 or A-4
			34–65	Sandy loam and loam	SM or ML	A-4
Clifty: Ck	3½–6+	[1] 4+	0–18	Silt loam	ML or GM	A-4
			18–50	Gravelly silt loam	GW-GM or GM	A-1
Cotaco, neutral variant: CoB	4–6+	1–2	0–13	Fine sandy loam	SM or ML	A-4
			13–50	Loam or gravelly loam.	SM or ML	A-4
Cranston: CrB, CrC, CrD, CrE, CrF	4+	6+	0–13	Gravelly silt loam	ML	A-4
			13–76	Gravelly silt loam	GM-GC or ML	A-4
Cuba: Cu	4–6+	[1] 4+	0–85	Silt loam	ML	A-4
Donahue: DoD, DoF	[3] 2–3½	6+	0–9	Sandy loam or loam	SM or ML	A-4
			9–15	Clay loam	CL	A-6
			15–34	Silty clay or clay	CH or MH	A-7
Gilpin: GlC, GlD	2½–3½	6+	0–10	Silt loam	ML	A-4
			10–32	Silty clay loam or shaly silt loam.	ML-CL	A-4 or A-6
Hartsells: HaC, HaD	2–3½	6+	0–12	Fine sandy loam	SM	A-2 or A-4
			12–26	Sandy clay loam or clay loam.	SC or CL	A-6
			26–36	Gravelly sandy loam	SM or GM	A-2 or A-1
Johnsburg: Jo	4+	[1] ½–1	0–15	Silt loam	ML	A-4
			15–55	Silt loam (fragipan)	ML or CL	A-4 or A-6
			55–75	Silt loam	ML	A-4
*Latham: LaC, LaD, LaE, LsD, LsE, LsF. For Shelocta part of LsD, LsE, and LsF, see Shelocta series.	2½–3½	1½–2	0–6	Silt loam	ML	A-4
			6–11	Silty clay loam	CL	A-6
			11–36	Silty clay	CL, MH or CL-ML	A-7 or A-6
Monongahela: MoB	6+	1½–2	0–21	Fine sandy loam, loam, or sandy clay loam.	SM or ML	A-2 or A-4
			21–48	Sandy clay loam or loam (fragipan).	ML or CL	A-4
			48–84	Light clay loam	CL or ML-CL	A-4 or A-6

properties significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for
The symbol < means less than; the symbol > means more than]

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No 4 (4.7 mm)	No 10 (2.0 mm)	No 40 (0.42 mm)	No 200 (0.074 mm)				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
0–5	90–100	75–100	60–95	40–75	0.6–2.0	0.15–0.18	4.5–5.0	Low.
0–5	90–100	75–100	60–95	45–80	0.6–2.0	0.13–0.16	4.5–5.0	Low.
0–5	85–100	65–100	60–95	30–55	0.6–2.0	0.12–0.15	4.5–5.0	Low.
0–10	60–90	60–90	55–85	45–80	0.6–6.3	0.12–0.18	4.5–5.0	Low.
10–20	25–60	20–55	15–50	10–45	2.0–6.3	0.06–0.10	4.5–5.0	Low.
([2])	100	100	95–100	70–90	0.6–2.0	0.17–0.21	4.5–5.0	Low.
0–10	90–95	85–95	80–95	60–85	0.6–2.0	0.18–0.21	6.6–7.3	Low.
5–10	95–100	90–95	85–90	75–90	0.20–0.6	0.16–0.19	6.6–7.3	Moderate.
5–10	90–100	90–95	85–95	65–90	0.20–0.6	0.12–0.15	6.6–7.3	Moderate to high.
([2])	100	100	70–85	30–55	2.0–6.3	0.13–0.15	4.5–5.5	Low.
([2])	100	100	65–90	35–55	2.0–6.3	0.12–0.16	4.5–5.0	Low.
0–5	75–95	75–95	50–90	35–80	0.6–2.0	0.10–0.19	4.5–5.0	Low.
5–20	20–50	10–40	10–35	5–25	>6.3	0.03–0.06	4.5–5.0	Low.
0–5	90–95	90–95	70–85	35–55	2.0–6.3	0.13–0.15	6.6–7.3	Low.
0–10	80–95	75–90	70–85	40–75	0.6–2.0	0.11–0.16	6.1–7.3	Low.
0–10	70–85	60–80	60–75	50–65	2.0–6.3	0.12–0.16	4.5–5.0	Low.
0–15	65–85	55–75	50–70	45–60	2.0–6.3	0.09–0.13	4.5–5.0	Low.
([2])	100	95–100	90–100	70–90	0.63–2.0	0.18–0.22	4.5–5.5	Low.
2–10	85–95	80–90	65–75	35–65	2.0–6.3	0.13–0.15	4.5–5.5	Low.
2–10	90–95	90–95	85–90	70–80	0.6–2.0	0.15–0.19	4.5–5.5	Moderate.
0–5	95–100	95–100	80–100	65–85	0.2–0.6	0.10–0.12	5.6–7.3	Moderate to high.
([2])	85–100	80–90	70–85	60–85	0.6–2.0	0.17–0.20	4.5–5.0	Low.
0–10	70–85	65–80	60–75	55–70	0.6–2.0	0.12–0.15	4.5–5.0	Low.
([2])	95–100	85–95	75–90	30–45	2.0–6.3	0.13–0.15	4.5–5.0	Low.
([2])	95–100	85–95	75–90	40–60	2.0–6.3	0.14–0.17	4.5–5.0	Low.
0–5	55–75	50–75	40–65	15–30	2.0–6.0	0.08–0.10	4.5–5.0	Low.
([2])	100	100	90–100	70–95	0.6–2.0	0.18–0.22	4.5–6.5	Low.
([2])	100	100	90–100	80–95	<0.06	0.10–0.15	4.5–5.0	Low.
([2])	100	100	90–100	70–95	0.2–0.6	0.10–0.15	4.5–5.0	Low.
([2])	100	95–100	90–95	70–90	0.6–2.0	0.18–0.21	4.5–5.0	Low.
([2])	100	95–100	90–95	80–90	0.6–2.0	0.16–0.17	4.5–5.0	Low.
([2])	95–100	90–100	85–100	80–100	0.06–0.2	0.11–0.14	4.5–5.0	Moderate to high.
([2])	100	100	70–85	30–55	2.0–6.3	0.13–0.16	4.5–6.5	Low.
([2])	100	100	80–95	55–75	0.06–0.20	0.08–0.12	4.5–5.0	Low.
([2])	100	100	80–95	60–80	0.6–2.0	0.08–0.12	4.5–5.0	Low.

TABLE 6.—*Estimates of soil*

Soil series and map symbols	Depth to bedrock	Depth to seasonal high water table	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Morehead: Mp	6+	[1] 1–2	0–18	Silt loam	ML	A-4
			18–70	Silt loam	ML or CL	A-4 or A-6
Mullins: Mr	4+	[1] 0–½	0–9	Silt loam	ML	A-4
			9–16	Silt loam	CL or ML	A-4 or A-6
			16–48	Silty clay loam (fragipan).	CL–ML or ML	A-6
			48–60	Silty clay loam	CL	A-6
*Muse: MsB, MsC, MsD, MsE, MtF. For Trappist part of MtF, see Trappist series.	5+	6+	0–5	Silt loam	ML	A-4
			5–11	Silty clay loam	CL	A-6 or A-7
			11–62	Silty clay or clay	CL or MH	A-7
Pope: Po, Pp	4+	[1] 4+	0–85	Fine sandy loam	SM or GM	A-2 or A-4
Ramsey. Mapped only with Steinsburg soils.	[3] 1–1½	6+	0–14	Sandy loam	SM	A-2 or A-4
Renox: ReB, ReC	5+	6+	0–14	Gravelly fine sandy loam.	SM or ML	A-4
			14–38	Gravelly clay loam	ML or GM–GC	A-4
			38–65	Gravelly loam	ML, GM or SM	A-4
*Rigley: RgB, RgC, RgD, RgE, RIF, RoD, RoE, RoF. For Donahue part of RoD, RoE, and RoF, see Donahue series.	5+	6+	0–9	Fine sandy loam	SM	A-2 or A-4
			9–45	Gravelly sandy loam	SM, SC or CL	A-2 or A-6
			45–55	Gravelly sandy loam	CL–ML, SM, SC	A-6 or A-7
Shelocta. Mapped only with Latham soils.	4+	6+	0–14	Silt loam	ML	A-4
			14–47	Silty clay loam	CL	A-6
			47–64	Channery silty clay	CL or MH	A-7
Skidmore: Sd	3½–6+	[1] 4+	0–18	Gravelly fine sandy loam or gravelly loam.	GM	A-1, A-2
			18–70	Gravelly or very channery sandy loam.	GW–GM, GM	A-1
*Steinsburg: SrD, SrF. For Ramsey part, see Ramsey series.	[3] 2–3	6+	0–26	Sandy loam	SM or GM	A-2
Stendal: St	4–6+	[1] ½–1½	0–55	Silt loam	ML	A-4
			55–80	Silty clay loam	ML or CL	A-4 or A-6
Stendal, neutral variant: Sv	4–6+	[1] ½–1	0–60	Fine sandy loam	SM	A-4
Strip mines: Sx. Too variable to rate.						
Tilsit: TIB, TIC	3½–6+	1½–2	0–24	Silt loam	ML	A-4
			24–56	Silt loam (fragipan)	ML or CL–ML	A-4 or A-6
			56–65	Silt loam	ML	A-4
Trappist. Mapped only with Muse soils.	2–3	6+	0–6	Silt loam	ML	A-4
			6–28	Silty clay loam or silty clay.	MH or CL	A-7
			28–35	Very shaly clay	GC	A-2 or A-1
Whitley: WhC, WhD, WtA, WtB, WtC	3–5+	[1] 4+	0–21	Silt loam	ML	A-4
			21–38	Silty clay loam	CL	A-6

[1] Subject to flooding in some places.
[2] Few or no fragments larger than 3 inches.

properties significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No 4 (4.7 mm)	No 10 (2.0 mm)	No 40 (0.42 mm)	No 200 (0.074 mm)				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
[2]	100	100	90–100	70–80	0. 6–2. 0	0. 18–0. 22	4. 5–6. 0	Low.
[2]	100	100	90–100	85–95	0. 6–2. 0	0. 17–0. 20	4. 5–5. 1	Low.
[2]	100	100	95–100	70–95	0. 6–2. 0	0. 18–0. 22	4. 5–5. 5	Low.
[2]	100	100	95–100	85–95	0. 2–0. 6	0. 17–0. 18	4. 5–5. 0	Low.
[2]	100	100	95–100	85–95	<0. 06	0. 08–0. 12	4. 5–5. 0	Low.
[2]	100	100	95–100	85–95	0. 2–0. 6	0. 08–0. 12	4. 5–5. 0	Low.
[2]	100	100	95–100	70–90	0. 6–2. 0	0. 18–0. 22	5. 1–5. 5	Low.
[2]	100	100	95–100	90–95	0. 2–0. 6	0. 17–0. 18	4. 5–5. 0	Moderate.
[2]	100	95–100	95–100	90–95	0. 2–0. 6	0. 12–0. 15	4. 5–5. 0	Moderate to high.
0–5	65–100	60–100	45–75	25–40	2. 0–6. 3	0. 09–0. 14	4. 5–5. 0	Low.
0–5	70–95	65–95	40–60	25–45	>6. 3	0. 09–0. 12	4. 5–5. 0	Low.
0–5	65–90	60–90	50–80	35–55	2. 0–6. 3	0. 15–0. 17	6. 6–7. 3	Low.
0–5	65–95	65–95	65–85	40–55	0. 6–2. 0	0. 12–0. 16	6. 6–7. 3	Low.
0–5	65–85	60–80	50–75	35–55	0. 6–6. 3	0. 11–0. 14	6. 6–7. 3	Low.
2–15	70–90	65–90	55–75	30–40	2. 0–6. 3	0. 08–0. 15	4. 5–5. 0	Low.
2–10	80–100	65–90	65–85	30–60	2. 0–6. 3	0. 09–0. 12	4. 5–5. 0	Low.
0–10	85–95	70–90	65–75	40–65	2. 0–6. 3	0. 09–0. 12	4. 5–5. 0	Low.
[2]	75–95	70–95	70–90	65–85	0. 6–2. 0	0. 18–0. 22	5. 1–6. 0	Low.
0–5	75–100	75–90	70–90	65–80	0. 6–2. 0	0. 16–0. 19	4. 5–5. 0	Low.
0–5	85–100	85–100	85–95	75–90	0. 2–0. 6	0. 14–0. 16	4. 5–5. 0	Moderate.
[2]	50–60	45–55	35–50	20–30	2. 0–6. 3	0. 08–0. 11	5. 6–6. 5	Low.
10–15	20–50	15–45	10–30	5–15	>6. 3	0. 03–0. 07	6. 1–6. 5	Low.
0–10	60–95	40–95	40–75	25–35	2. 0–6. 3	0. 07–0. 10	4. 5–5. 0	Low.
[2]	100	95–100	90–95	75–90	0. 6–2. 0	0. 18–0. 22	4. 5–5. 0	Low.
[2]	100	95–100	90–95	85–90	0. 6–2. 0	0. 15–0. 18	4. 5–5. 0	Low.
[2]	95–100	90–100	80–95	40–50	2. 0–6. 3	0. 13–0. 16	6. 6–7. 3	Low.
[2]	95–100	95–100	90–100	70–90	0. 6–2. 0	0. 18–0. 22	4. 5–5. 0	Low.
[2]	90–100	90–100	90–100	75–90	<0. 2	0. 10–0. 15	4. 5–5. 0	Low.
[2]	95–100	95–100	95–100	80–100	0. 6–2. 0	0. 10–0. 15	4. 5–5. 0	Low.
[2]	95–100	90–95	85–95	70–90	0. 6–2. 0	0. 17–0. 21	4. 5–5. 0	Low.
0–5	70–100	65–90	60–85	60–80	0. 2–0. 6	0. 11–0. 14	4. 5–5. 0	Moderate.
[2]	30–45	25–40	25–40	20–35	0. 2–0. 6	0. 05–0. 09	4. 5–5. 0	Moderate.
[2]	95–100	90–100	80–95	75–90	0. 6–2. 0	0. 18–0. 22	4. 5–5. 0	Low.
[2]	95–100	90–100	90–95	80–90	0. 6–2. 0	0. 16–0. 19	4. 5–5. 0	Low.

[3] Rock outcrops cover 3 to 25 percent of the surface of these soils.

TABLE 7.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear

Soil series	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds: Reservoir area
Allegheny: AlB, AlC, AlD	Good	Not suitable	Fair: SC, SM, and ML material; more than 30 percent fines.	Features generally favorable.	Pervious material.
Berks: BeF	Poor: gravelly; slope.	Not suitable	Poor: slope	Bedrock at depth of 1½ to 3 feet; slope.	Slope; bedrock at depth of 1½ to 3 feet; pervious.
Bonnie: Bo	Poor: poorly drained.	Not suitable	Poor: poorly drained.	Seasonal high water table at depth of 0 to ½ foot; subject to flooding.	Seasonal high water table at depth of 0 to ½ foot; subject to flooding; pervious substratum.
Brookside: BrF	Poor: stony and clayey below depth of 7 inches; slope.	Not suitable	Poor: high group index; slope; stony.	Slope; moderate to high shrink-swell potential.	Slope
Chavies, acid variant: ChB	Good	Not suitable	Fair to good: more than 30 percent fines.	Some areas subject to flooding.	Moderately rapid permeability.
Clifty: Ck	Fair: gravelly below depth of 18 inches.	Fair below depth of 18 inches for gravel: GW-GM or GM material.	Fair to good: GW-GM or GM material.	Subject to flooding.	Highly permeable material; flooding.
Cotaco, neutral variant: CoB	Good	Not suitable	Fair: SM or ML material; more than 30 percent fines.	Seasonal high water table at depth of 1 to 2 feet.	Seasonal high water table at depth 1 to 2 feet; moderately pervious material.
Cranston: CrB, CrC, CrD, CrE, CrF.	Poor: gravelly; slope in most places.	Not suitable	Fair to good: group index of less than 5; more than 30 percent fines; slope in some places.	Slope in some places.	Slope in some places; pervious material.
Cuba: Cu	Good	Not suitable	Fair: ML material.	Subject to flooding.	Moderately permeable material; subject to flooding.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for in the first column of this table]

Soil features affecting—Continued						
Ponds—Con. Embankment	Drainage for crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Shallow excavations
Fair to good stability; some material is subject to piping.	Well drained	Slope in some places is more than 12 percent.	Slope in some places is more than 12 percent.	Slope in some places.	Features generally favorable.	Features generally favorable.
Moderately pervious material; slight piping hazard; slope.	Well drained	Slope; low available water capacity.	Slope	Bedrock at depth of 1½ to 3 feet; gravelly subsoil; slope.	Slope	Bedrock at depth of 1½ to 3 feet; slope.
Fair stability; poor compaction; piping hazard.	Seasonal high water table at depth of 0 to ½ foot; subject to flooding.	Seasonal high water table at depth of 0 to ½ foot; subject to flooding.	Nearly level	Nearly level	Seasonal high water table at depth of 0 to ½ foot; subject to flooding.	Seasonal high water table at depth of 0 to ½ foot; subject to flooding.
Slope; some material is plastic; medium to high compressibility.	Well drained	Slope	Slope	Slope	Plastic material: slope.	Stony; slope.
Moderately pervious material; subject to piping.	Well drained; subject to flooding.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Subject to flooding.	Features generally favorable.
Highly pervious material; fair resistance to piping.	Well drained; subject to flooding.	Low available water capacity.	Nearly level	Nearly level	Subject to flooding.	Subject to flooding.
Moderately pervious material; piping hazard.	Seasonal high water table at depth of 1 to 2 feet.	Seasonal high water table at depth of 1 to 2 feet.	Features generally favorable.	Features generally favorable.	Seasonal high water table at depth of 1 to 2 feet.	Seasonal high water table at depth of 1 to 2 feet.
Moderately pervious material; some material subject to piping.	Well drained	Moderately rapid permeability; medium available water capacity; slope in some places is more than 12 percent.	Slope in some places.	Slope in most places.	Slope	Slope in some places.
Fair stability; poor compaction; piping hazard.	Well drained; subject to flooding.	Subject to flooding.	Nearly level	Nearly level	Subject to flooding; high frost action.	Subject to flooding.

TABLE 7.—*Engineering*

Soil series	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds: Reservoir area
Donahue: DoD, DoF	Poor: stony; some rock outcrops; slope.	Not suitable	Poor: bedrock at depth of 2 to 3½ feet; plastic material.	Bedrock at depth of 2 to 3½ feet; plastic material; slope; rock outcrops.	Subject to seepage; bedrock at depth of 2 to 3½ feet; slope.
Gilpin: GlC, GlD	Fair: bedrock at depth of 2½ to 3½ feet; slope in some places.	Not suitable	Fair: ML or CL material; bedrock at depth of 2½ to 3½ feet.	Bedrock at depth of 2½ to 3½ feet; slope in some places.	Bedrock at depth of 2½ to 3½ feet.
Hartsells: HaC, HaD	Fair: bedrock at depth of 2 to 3½ feet; slope in some places.	Not suitable	Fair: SM, SC, GM, or CL material; more than 30 percent fines; bedrock at depth of 2 to 3½ feet.	Bedrock at depth of 2 to 3½ feet; slope in some places.	Pervious material; bedrock at depth of 2 to 3½ feet.
Johnsburg: Jo	Good	Not suitable	Fair: ML or CL material; medium compressibility.	Seasonal high water table at depth of ½ to 1 foot.	Seasonal high water table at depth of ½ to 1 foot.
*Latham: LaC, LaD, LaE, LsD, LsE, LsF. For Shelocta part of LsD, LsE, and LsF, see Shelocta series.	Fair: clayey below depth of 11 inches.	Not suitable	Poor: CL or MH material; plasticity index of more than 15.	Slope in some places; shale at depth of 2½ to 3½ feet; moderate to high shrink-swell potential.	Slope in some places; bedrock at depth of 2½ to 3½ feet.
Monongahela: MoB	Good	Not suitable	Fair: SM-SC, CL, or ML-CL material.	Seasonal high water table at depth of 1½ to 2 feet.	Substratum has pervious layers in places.
Morehead: Mp	Good	Not suitable	Fair: ML or CL material; medium compressibility.	Seasonal high water table at depth of 1 to 2 feet; some areas subject to flooding.	Seasonal high water table at depth of 1 to 2 feet; pervious substratum.
Mullins: Mr	Poor: seasonal high water table at depth of 0 to ½ foot.	Not suitable	Poor: poorly drained.	Seasonal high water table at depth of 0 to ½ foot.	Seasonal high water table at depth of 0 to ½ foot.

interpretations—Continued

Soil features affecting—Continued						
Ponds—Con. Embankment	Drainage for crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Shallow excavations
Clayey; moderate to high shrink-swell potential; poor compaction; high compressibility.	Well drained	Slope; moderately slow permeability.	Bedrock outcrops; clayey subsoil; slope.	Clayey subsoil; slope; bedrock outcrops.	Plastic material; slope in most places.	Bedrock at depth of 2 to 3½ feet; some rock outcrops; stony; slope in some places.
Medium compressibility.	Well drained	Slope in some places is more than 12 percent; medium available water capacity.	Bedrock at depth of 2½ to 3½ feet; slope in some places is more than 10 percent.	Bedrock at depth of 2½ to 3½ feet; slope in some places.	Medium frost action.	Bedrock at depth of 2½ to 3½ feet.
Moderately pervious material; subject to piping.	Well drained	Medium available water capacity; slope in some places.	Bedrock at depth of 2 to 3½ feet; slope in some places.	Bedrock at depth of 2 to 3½ feet; slope in some places.	Features generally favorable.	Bedrock at depth of 2 to 3½ feet.
Fair stability; medium compressibility; fair compaction.	Very slow permeability in fragipan at depth of about 15 inches.	Very slow permeability in fragipan at depth of about 15 inches; seasonal high water table at depth of ½ to 1 foot.	Fragipan at depth of about 15 inches.	Fragipan at depth of about 15 inches.	Seasonal high water table at depth of ½ to 1 foot; medium frost action.	Seasonal high water table at depth of ½ to 1 foot.
Fair to poor stability; high compressibility; moderate to high shrink-swell potential.	Slow permeability.	Slow permeability; slope in some places is more than 12 percent.	Clayey subsoil; slope in some places is more than 12 percent.	Slope in most places; clayey subsoil; erodible.	Plastic material; slope in some places.	Clayey material; slope in some places; shale at depth of 2½ to 3½ feet.
Fair stability; some material moderately pervious and subject to piping.	Slow permeability in fragipan at depth of about 21 inches.	Slow permeability in fragipan at depth of about 21 inches; seasonal high water table at depth of 1½ to 2 feet.	Fragipan at depth of about 21 inches.	Fragipan at depth of about 21 inches.	Seasonal high water table at depth of 1½ to 2 feet.	Seasonal high water table at depth of 1½ to 2 feet.
Fair stability; medium compressibility; some material subject to piping.	Seasonal high water table at depth of 1 to 2 feet; flooding.	Seasonal high water table at depth of 1 to 2 feet.	Nearly level	Nearly level	Seasonal high water table at depth of 1 to 2 feet; medium frost action.	Seasonal high water table at depth of 1½ to 2 feet.
Fair stability; medium compressibility.	Very slow permeability in fragipan at depth of about 16 inches.	Very slow permeability in fragipan at depth of about 16 inches; seasonal high water table at depth of 0 to ½ foot.	Nearly level	Nearly level	Seasonal high water table at depth of 0 to ½ foot; medium to high frost action.	Seasonal high water table at depth of 0 to ½ foot.

TABLE 7.—*Engineering*

Soil series	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds: Reservoir area
*Muse: MsB, MsC, MsD, MsE, MtF. For Trappist part of MtF, see Trappist series.	Poor: less than 8 inches of good material; slope in some places.	Not suitable	Poor: CL or MH material; plastic index of 15.	Fair to poor stability; moderate to high shrink-swell potential; slope in some places.	Slope in some places.
Pope: Po, Pp	Good to poor: some areas are gravelly.	Not suitable	Good: 25 to 45 percent fines.	Subject to flooding.	Pervious material; subject to flooding.
Ramsey. Mapped only with Steinsburg soils.	Poor: bedrock at depth of 1 to 1½ feet; rocky surface; slope in most places.	Poor: bedrock at depth of 1 to 1½ feet; SM material; excessive fines.	Fair: bedrock at depth of 1 to 1½ feet; 25 to 45 percent fines.	Bedrock at depth of 1 to 1½ feet; slope in most places.	Bedrock at depth of 1 to 1½ feet; slope in most places.
Renox: ReB, ReC	Poor: most areas are gravelly.	Not suitable	Fair: low plasticity; 35 to 55 percent fines.	Features generally favorable.	Pervious material
*Rigley: RgB, RgC, RgD, RgE, RlF, RoD, RoE, RoF. For Donahue part of RoD, RoE, and RoF, see Donahue series.	Fair to poor: gravelly or stony; slope.	Not suitable	Fair to poor: group index of 0 to 10; slope in some places.	Slope in some places.	Slope in some places; pervious substratum in some areas.
Shelocta. Mapped only with Latham soils.	Fair to poor: content of coarse fragments 5 to 25 percent.	Not suitable	Fair: A-4, A-6, and A-7 and group index of 0 to 16.	Slope in most places.	Previous substratum in some areas; slope in some places.
Skidmore: Sd	Poor: content of coarse fragments.	Fair for gravel: GW-GM or GM.	Good	Subject to flooding.	Highly pervious
*Steinsburg: SrD, SrF. For Ramsey part, see Ramsey series.	Poor: bedrock at depth of 2 to to 3 feet; numerous rock outcrops; slope in most places.	Poor: excessive fines.	Fair to good: bedrock at depth of 2 to 3 feet: numerous bedrock outcrops; slope.	Bedrock at depth of 2 to 3 feet; bedrock outcrops; slope.	Pervious material; bedrock at depth of 2 to 3 feet.
Stendal: St	Good	Not suitable	Fair: ML material.	Seasonal high water table at at depth of ½ to 1½ feet; flooding.	Pervious substratum; seasonal high water table at depth of ½ to 1½ feet; flooding.

interpretations—Continued

Soil features affecting—Continued						
Ponds—Con. Embankment	Drainage for crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Shallow excavations
Fair to poor stability; high compressibility; moderate to high shrink-swell potential.	Well drained	Slope in some places; moderately slow permeability.	Slope in some places.	Clayey subsoil; slope in most places; erodible.	Plastic material	Slope in some places.
Piping hazard; moderately pervious.	Well drained; subject to flooding.	Subject to flooding.	Nearly level	Nearly level	Subject to flooding.	Subject to flooding.
Pervious material; bedrock at depth of 1 to 1½ feet.	Somewhat excessively drained.	Slope; very low available water capacity; rocky.	Slope; bedrock outcrops; bedrock at depth of 1 to 1½ feet.	Bedrock at depth of 1 to 1½ feet; numerous rock outcrops; very low available water capacity; slope.	Slope in some places.	Bedrock at depth of 1 to 1½ feet.
Pervious material; piping hazard.	Well drained	Features generally favorable.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Moderately pervious material.	Well drained	Slope in most places.	Slope in most places.	Slope in most places.	Slope in some places.	Slope in most places.
Fair to good stability; medium compressibility.	Well drained	Slope in most places.	Slope	Slope	Plastic material below depth of 47 inches; slope.	Slope in some places.
Pervious material.	Well drained; subject to flooding.	Low available water capacity; moderately rapid permeability.	Nearly level	Nearly level	Subject to flooding.	Subject to
Pervious material; subject to piping.	Well drained	Slope in most places; low available water capacity.	Slope in most places; rock outcrops; bedrock at depth of 2 to 3 feet.	Erodible; bedrock at depth of 2 to 3 feet; numerous rock outcrops; slope.	Slope in some places.	Bedrock at a depth of 2 to 3 feet; numerous bedrock outcrops; slope in some places.
Piping hazard; fair stability.	Seasonal high water table at depth of ½ to 1½ feet; flooding.	Seasonal high water table at depth of ½ to 1½ feet; subject to flooding.	Nearly level	Nearly level	Seasonal high water table at depth of ½ to 1½ feet; flooding.	Seasonal high water table at depth of ½ to 1½ feet; subject to flooding.

TABLE 7.—*Engineering*

Soil series	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds: Reservoir area
Stendal, neutral variant: Sv	Good	Not suitable	Fair: SM material; 40 to 50 percent fines.	Seasonal high water table at depth of ½ to 1 foot; subject to flooding.	Pervious substratum; seasonal high water table at depth of ½ to 1 foot; flooding.
Strip mines: Sx. Too variable to rate.					
Tilsit: TlB, TlC	Good	Not suitable	Fair to good: A–4 and A–6 and group index of 0 to 8.	Seasonal high water table at depth of 1½ to 2 feet.	Features generally favorable.
Trappist. Mapped only with Muse soils.	Poor: clayey at depth below 6 inches; stony; slope.	Not suitable	Poor: MH or CL material; plasticity index of more than 15; slope.	Bedrock at depth of 2 to 3 feet; slope.	Bedrock at depth of 2 to 3 feet; slope.
Whitley: WhC, WhD, WtA, WtB, WtC.	Good	Not suitable	Fair: medium compressibility; ML or CL material.	Bedrock at depth of 3 to 5 feet; low areas subject to flooding.	Moderately previous material.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*23*), used by SCS engineers, the Department of Defense, and others, and the AASHO system (*1*), adopted by the American Association of State Highway Officials. Both systems are explained in the PCA Soil Primer (*15*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the survey area.

Engineering test data

Table 5 contains the results of engineering tests performed by the Kentucky Department of Highways on several important soils in the survey area. This table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

The columns in table 5 that are not self-explanatory are explained as follows:

Moisture-density data are important in earthwork. If a soil material is compacted at successively higher moisture content, by a constant force, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest

interpretations—Continued

Soil features affecting—Continued						
Ponds—Con. Embankment	Drainage for crops and pasture	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Shallow excavations
Piping hazard	Seasonal high water table at depth of ½ to 1 foot; subject to flooding.	Seasonal high water table at depth of ½ to 1 foot; subject to flooding.	Nearly level	Nearly level	Seasonal high water table at depth of ½ to 1 foot; subject to flooding.	Seasonal high water table at depth of ½ to 1 foot; subject to flooding.
Fair to poor stability; some material subject to piping.	Slowly permeable in fragipan at depth of about 24 inches.	Slowly permeable in fragipan at depth of about 24 inches.	Fragipan at depth of about 24 inches.	Fragipan at depth of about 24 inches.	Seasonal high water table at depth of 1½ to 2 feet; medium frost action.	Seasonal high water table at depth of 1½ to 2 feet.
Fair to poor stability; high compressibility; moderate to high shrink-swell potential.	Well drained	Moderately slow permeability: medium available water capacity; slope.	Shale rock at depth of 2 to 3 feet; slope.	Shale rock at depth of 2 to 3 feet; slope.	Slope; clayey material.	Slope; clayey material; shale rock at depth of 2 to 3 feet.
Fair to good stability; some piping hazard.	Well drained	Slope in places is more than 12 percent.	Slope in a few areas.	Erodible where slopes are more than 6 percent.	Medium frost action.	Bedrock at depth of 3 to 5 feet.

dry density obtained in the compactive test is the *maximum dry density*. Generally, the maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density at the optimum moisture content.

The California bearing ratio is used to determine the bearing value of soil by expressing the ratio as a percentage of a standard penetration value for crushed stone.

Mechanical analyses show the percentages, by weight, or soil particles that pass sieves of specified sizes. Sand and coarser materials do not pass the No. 200 sieve. Silt and clay pass the No. 200 sieve. Silt is the material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is the material that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method rather than by the pipette method most soil scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil material. As the moisture content of a clayey soil material is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to the plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Estimated soil properties

Estimates of several soil properties significant in engineering are given in table 6 for all of the soils in the survey area. These estimates are made for representative soil profiles by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in this table.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in the table in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. Loam, for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel

or other particles coarser than sand, an appropriate modifier is added, as for example, gravelly loamy sand.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 6 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and type of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or of material having this rating.

Engineering interpretations

The engineering interpretations given in table 7 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby, and on the experience of engineers and soil scientists with the soils of the survey area. In table 7, ratings are used to summarize limitations or suitability of the soils for topsoil, sand and gravel, and road fill. Those soil features not to be overlooked in planning, installation, and maintenance are listed in table 6 for highway location, ponds and reservoirs, embankments, drainage of cropland and pasture, irrigation, terraces and diversions, grassed waterways, winter grading, and shallow excavations.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and the absence of substances toxic to plants. Texture of the soil material and its content of stones and fragments affect suitability, but also considered in the ratings is damage that will result in the area from which topsoil is taken.

Sand and gravel are used in great quantities in many types of construction. The ratings in table 7 provide guidance about where to look for probable sources. A soil rated as a good or fair source of sand or gravel generally has a layer at least 3 feet thick, the top of which is at a depth of less than 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material in borrow areas.

Soil properties that most affect highway and road location are the traffic-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. A soil suitable for pond reservoir areas has low seepage, which is related to its permeability and depth to fractured or permeable bedrock or other permeable material (fig. 12).

Embankments require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among the unfavorable factors.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and of fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Waterway layout and construction are affected by such soil properties as texture, depth, and erodibility of the soil material; presence of stones or rock outcrops; and the steepness of slope. Other factors affecting waterways are seepage, natural soil drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Winter grading is affected chiefly by soil features that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Shallow excavations for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries are those that generally require

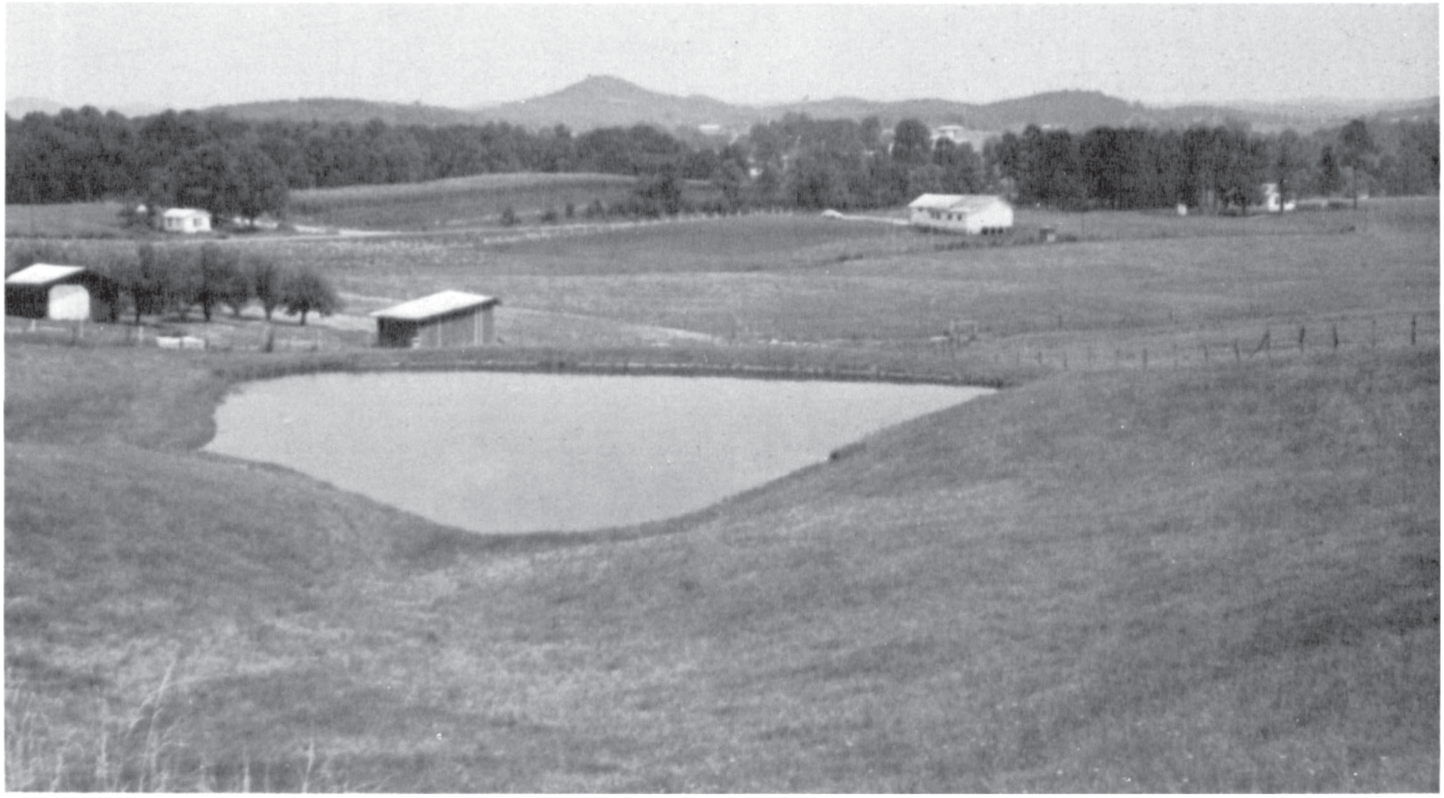

Figure 12.—Farm pond on a Latham silt loam. This soil provides good material for impoundment sites.

digging or trenching to a depth of less than 6 feet. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding and from a high water table.

Use of the Soils in Watershed Management [5]

The importance of the water resource in Menifee and Rowan Counties and Northwestern Morgan County is increased by the many miles of streams and proposed reservoirs that are or will be used for water supply and recreation. The behavior of water in a watershed is affected by the interrelationships between soil, geology, relief, climate, vegetation, and land use. Mining, roadbuilding, cultivating steep slopes, and clear-cutting forests in large blocks affect the severity of flooding, duration of streamflow, and water quality.

Understanding the physical characteristics of watersheds is important in determining the impact of land treatments on the behavior of the water resource.

Soils transmit and store varying amounts of water Soil texture, slope gradient, slope length, coarse fragments, pore space, soil structure, soil consistence, depth to water table, fragipan, and rock and plant cover are some of the important features that affect infiltration and permeability rates and water storage capacity. The infiltration and permeability rates and the water storage capacity affect the length of time rainwater takes to reach streams and the amount of water that enters the streams.

The differences in the soils of the survey area influence land-use potential and objective in watershed management. The soils have been studied, and on the basis of the data obtained they were placed in watershed management groups. Each group is described and the interpretations are given in table 8. In each group are soils that have similar water behavior characteristics under similar land use and to which similar management recommendations apply when considering problems, treatments, and objectives of watersheds.

Among the soil characteristics considered in placing each soil in a watershed management group are permeability rate, depth to seasonal high water table, depth to bedrock, depth to fragipan, slope gradient and length, natural drainage, landscape position, and erosion hazard.

The following paragraphs explain the ratings given for the columns in the table.

Dominant slope gradient and dominant slope length are those that apply to the soils in each group. Gradient was measured in the field, and length was measured on aerial photographs and topographic maps.

Inherent erosion hazard is a relative rating that applies to the bare soil surface without the protective effect of roots. Pore space and slope are considered in this estimate. Adjectives ratings used are none, slight, moderate, severe, and very severe.

[5] Assistance in preparing this section was provided by ROBERT TOBIASKI, watershed specialist, Daniel Boone National Forest.

TABLE 8.—*Interpretations of the soils for watershed management*

[Strip mines (Sx) are too variable to rate]

Watershed management groups, descriptions of the soils,[1] and map symbols	Dominant slope gradient	Dominant slope length	Inherent erosion hazard	Surface runoff potential	Subsurface runoff potential	Potential w[illegible] storage cap[illegible]
	Percent	*Yards*				
Group 1: Poorly drained and somewhat poorly drained, medium-textured, deep, nearly level soils on bottoms or terraces that are either flooded or ponded. Bo, CoB, Jo, Mp, Mr, St, Sv.	2	20–100	None to slight	Medium: 10 to 20 inches of effective depth for water storage.	Low: no natural outlets.	Low: 10 t[illegible] inches of [illegible] tive dept[illegible] water sto[illegible]
Group 2: Well-drained, moderately coarse textured, deep, nearly level soils on bottoms and low terraces that are subject to flooding. ChB, Ck, Po, Pp, Sd.	2	20–100	None to slight	Low: moderately rapid infiltration and permeability.	High: moderately rapid permeability; medium available water capacity.	Medium: [illegible] coarse-tex[illegible] or gravell[illegible] material.
Group 3: Well-drained, medium-textured, deep, nearly level soils on bottoms and low terraces that are subject to flooding. Cu, WtA.	1	50–100	Slight	Low: moderate infiltration and permeability.	Low: high available water capacity.	High: dee[illegible] medium [illegible] tured.
Group 4: Gently sloping to sloping, well-drained, deep, medium-textured to moderately coarse textured soils on toe slopes and fans. AlB, AlC, CrB, CrC, ReB, ReC, RgB, RgC, WtB, WtC.	6	50–100	Slight to moderate.	Low: moderate to moderately rapid infiltration and permeability; gently sloping to sloping.	Medium: substratum is generally gravelly.	High: dee[illegible]
Group 5: Strongly sloping, well-drained, medium-textured to moderately coarse textured soils on stream terraces and uplands. AlD, CrD, RgD, RoD.	15	50–150	Moderate to severe.	Medium: strongly sloping.	Medium: substratum is generally gravelly.	High: dee[illegible]
Group 6: Gently sloping to strongly sloping, well-drained, fine-textured soils on fans and toe slopes. MsB, MsC, MsD.	14	15–50	Severe	Medium: moderately slow permeability; gently sloping to strongly sloping.	Low: slowly permeable substratum.	High: dee[illegible] textured.
Group 7: Moderately steep to steep, well-drained, medium-textured to moderately coarse textured soils on stony side slopes, generally below cliffs. RgE, RlF, RoE, RoF.	35	100–300	Severe	Low: readily permeable; surface stones intercept some runoff.	Medium: substratum is pervious or water runs laterally along impervious substratum.	High: dee[illegible]
Group 8: Moderately steep to steep, well-drained, medium-textured soils on convex side slopes that are dissected by numerous branches. CrE, CrF.	40	150–350	Severe	High: steep convex slopes; many branches.	Medium: pervious substratum.	Medium to [illegible] gravelly.

Group 9: Gently sloping to sloping, moderately well drained, medium-textured soils on stream terraces and uplands. These soils have a fragipan at a depth of about 2 feet. MoB, TlB, TlC.	4	25–75	Slight to moderate.	Medium: 24 inches of effective depth.	Low to medium; some water runs laterally along top of fragipan in sloping areas.	High: deep
Group 10: Gently sloping to steep, well-drained, fine-textured, moderately deep, very rocky soils on ridgetops, upper slopes, and benches. DoD, DoF.	20	25–50	Very severe	High: thin surface layer; slowly permeable subsoil.	Low: practically impermeable lower subsoil.	Medium: s moderatel deep to ha rock.
Group 11: Sloping, well drained and moderately well drained, medium-textured and fine-textured, moderately deep soils on ridgetops. GlC, LaC, WhC.	8	15–50	Severe	Low: sloping ridges.	Low: slowly permeable subsoil or substratum.	High: soil shale have available capacity.
Group 12: Strongly sloping, well-drained, medium-textured to fine-textured, moderately deep and deep soils on ridges and upper side slopes. GlD, LaD, LsD, WhD.	15	25–50	Severe	Medium: strongly sloping.	Low: slowly permeable subsoil or substratum.	High: soil shale have available capacity.
Group 13: Moderately steep and steep, well-drained, medium-textured to fine textured, moderately deep to deep soils on side slopes. BrF, LaE, LsE, LsF, MsE, MtF.	45	100–250	Very severe	High: slope; moderately slow infiltration and permeability.	Medium: water moves laterally over slowly permeable layers of soil and shale.	High
Group 14: Sloping to strongly sloping, well-drained and somewhat excessively drained, moderately coarse textured soils on ridgetops. These soils are shallow to moderately deep to sandstone. Some are rocky. HaC, HaD, SrD.	14	25–50	Moderate to severe.	Low: rapid infiltration.	High: moderately rapid permeability; water moves laterally along sandstone bedrock.	Low: shall moderatel deep; mos coarse tex
Group 15: Moderately steep to steep, well-drained to somewhat excessively drained, moderately coarse textured, shallow to moderately deep, rocky soils on narrow ridges and upper side slopes above sandstone cliffs. SrF	35	50–150	Severe: lacks fine material to bind coarse sand particles.	Low: rapid infiltration.	High: moderately rapid and rapid permeability; water moves laterally along sandstone rock.	Low: shall moderatel deep; coa textured.
Group 16: Steep and very steep, well-drained, medium-textured, gravelly, moderately deep soils on very steep upper and lower side slopes and very narrow ridges. Some are rocky. BeF	60	100–200	Severe	Very high: very steep slopes.	High: rapid permeability; moderately deep soil.	Low: mod ly deep; h gravel co

[1] The texture given refers to the texture of the subsoil.

Surface runoff potential refers to the relative amount of water that can run off the surface and enter streams. Infiltration rate, soil depth for water storage, and slope are important in these ratings. Adjectives ratings used are very high, high, medium, and low.

Subsurface runoff potential refers to the gravitational water that moves through the soil and contributes to streamflow. Permeability rate, soil depth for water storage, type of underlying material, and slope are the dominant features that affect these ratings. Relative adjective ratings used are high, medium, and low.

Potential water storage capacity refers to the relative amount of water a soil can hold within its effective depth. Group 1 soils are deep to bedrock but shallow to the water table and therefore have only 10 to 20 inches of soil material available to store water. Depth, pore space, and organic-matter content affect storage capacity. The ability of a soil to hold water increases with increasing soil depth and increasing content of silt, clay, and organic matter. Relative ratings used are high, medium, and low.

Slump and slide hazard refers to the susceptibility of the soil to slump or slide when cut for roads or other purposes. Fine-textured soils retain more moisture than medium-textured soils and therefore slump more easily. Relative ratings used are slight, moderate, severe, and very severe.

TABLE 9.—*Degree and kind of limitations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that

Soil series and map symbols	Septic tank filter fields	Sewage lagoons	Buildings with basements	Camp areas
Allegheny:				
AlB	Slight	Moderate: slope; moderate permeability.	Slight	Slight
AlC	Moderate: slope	Severe: slope	Slight	Moderate: slope
AlD	Severe: slope	Severe: slope	Moderate: slope	Severe: slope
Berks: BeF	Severe: slope; bedrock at depth of 1½ to 3 feet.	Severe: slope; rapid permeability; bedrock at depth of 1½ to 3 feet.	Severe: slope; bedrock at depth of 1½ to 3 feet.	Severe: slope
Bonnie: Bo	Severe: seasonal high water table; flooding.	Severe: flooding	Severe: seasonal high water table; flooding.	Severe: wetness; flooding.
Brookside: BrF	Severe: slope; moderately slow permeability.	Severe: slope	Severe: slope; moderate to high shrink-swell potential.	Severe: slope; stony
Chavies, acid variant: ChB.	Slight	Severe: moderately rapid permeability.	Slight	Slight
Clifty: Ck	Severe: flooding	Severe: flooding; rapid permeability in substratum.	Severe: flooding	Moderate: flooding
Cotaco, neutral variant: CoB.	Severe: seasonal high water table.	Moderate: moderate permeability.	Severe: seasonal high water table.	Moderate: wetness
Cranston:				
CrB	Slight	Severe: moderately rapid permeability.	Slight	Moderate: coarse fragments.
CrC	Moderate: slope	Severe: slope; moderately rapid permeability.	Slight	Moderate: slope; coarse fragments.
CrD	Severe: slope	Severe: slope; moderately rapid permeability.	Moderate: slope	Severe: slope
CrE, CrF	Severe: slope	Severe: slope; moderately rapid permeability.	Severe: slope	Severe: slope

Town and Country Planning

Soils are a very important consideration in most uses of land. The interpretations in this section point out soil-related limitations and problems expected to be encountered for town and country uses. The most severe limitations listed can be overcome if the cost involved can be justified. The information is not intended to eliminate the need for onsite investigations for specific uses, but rather to serve as a guide for screening sites and for planning more detailed investigations.

In table 9 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained if needed. A *slight* limitation means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intensive maintenance, or a combination of these is required.

The types of limitations, expressed in terms of soil characteristics or properties, are shown only for the moderate and severe ratings. Some of these limitations are expressed in terms that may not be found in a standard dictionary or they may have special meaning. These are defined in the Glossary in the back of this survey.

Following are explanations of some of the columns in table 9.

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in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Streets and low-cost roads	Playgrounds	Picnic areas	Lawns and landscaping	Cemeteries	Paths and trails
Slight to moderate: good to fair traffic-supporting capacity.	Moderate: slope.	Slight.	Slight.	Slight.	Slight.
Moderate: slope; good to fair traffic- supporting capacity.	Severe: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Slight.
Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Severe: slope; bedrock at depth of 1½ to 3 feet.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope; bedrock at depth of 1½ to 3 feet.	Severe: slope.
Severe: seasonal high water table; flooding.	Severe: wetness; flooding.	Severe: wetness.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: wetness.
Severe: slope.	Severe: slope; stony.	Severe: slope.	Severe: slope; stony.	Severe: slope; stony.	Severe: slope.
Slight.	Slight to moderate: slope.	Slight.	Slight.	Slight.	Slight.
Severe: flooding.	Severe: flooding.	Slight.	Moderate: flooding.	Severe: flooding.	Slight.
Moderate: seasonal high water table.	Moderate: wetness.	Slight.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Slight.
Slight.	Severe: coarse fragments.	Moderate: coarse fragments.	Slight.	Slight.	Moderate: coarse fragments.
Moderate: slope.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.	Moderate: slope.	Moderate: slope.	Moderate: coarse fragments.
Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope; coarse fragments.
Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 9.—*Degree and kind of limitations*

Soil series and map symbols	Septic tank filter fields	Sewage lagoons	Buildings with basements	Camp areas
Cuba: Cu	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding
Donahue:				
DoD	Severe: moderately slow permeability; slope; bedrock at depth of 2 to 3½ feet.	Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: high compressibility and shrink-swell potential; bedrock at depth of 2 to 3½ feet.	Moderate to severe: rockiness; moderately slow permeability; slope.
DoF	Severe: moderately slow permeability; slope; bedrock at depth of 2 to 3½ feet.	Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: high compressibility and shrink-swell potential; bedrock at depth of 2 to 3½ feet; slope.	Severe: slope
Gilpin:				
GlC	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Moderate: slope
GlD	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope
Hartsells:				
HaC	Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: slope; bedrock at depth of 2 to 3½ feet; moderately rapid permeability.	Severe: slope; bedrock at depth of 2 to 3½ feet.	Moderate: slope
HaD	Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: slope; bedrock at depth of 2 to 3½ feet; moderately rapid permeability.	Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: slope
Johnsburg: Jo	Severe: seasonal high water table; very slow permeability.	Slight to moderate: CL or ML soil material.	Severe: seasonal high water table.	Moderate: wetness; very slow permeability.
* Latham:				
LaC	Severe: slow permeability; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: high compressibility; moderate to high shrink-swell potential; bedrock at depth of 2½ to 3½ feet.	Moderate: slope; slow permeability.
LaD, LsD	Severe: slope; slow permeability; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: high compressibility; moderate to high shrink-swell potential; bedrock at depth of 2½ to 3½ feet.	Severe: slope
LaE, LsE, LsF For Shelocta part of LsD, LsE, and LsF, see Shelocta series.	Severe: slope; slow permeability; bedrock at depth of 2½ to 3½ feet.	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope; high compressibility; moderate to high shrink-swell potential; bedrock at depth of 2½ to 3½ feet.	Severe: slope
Monongahela: MoB	Severe: slow permeability; seasonal high water table.	Moderate: slope	Moderate: seasonal high water table; medium compressibility.	Moderate: slow permeability.
Morehead: Mp	Severe: seasonal high water table; flooding in some areas.	Moderate: moderate permeability; some ML material.	Severe: seasonal high water table; medium compressibility.	Moderate: wetness
Mullins: Mr	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table; flooding in some areas.	Severe: wetness; very slow permeability.

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Streets and low-cost roads	Playgrounds	Picnic areas	Lawns and landscaping	Cemeteries	Paths and trails
Severe: flooding	Severe: flooding	Slight	Moderate: flooding.	Severe: flooding	Slight.
Severe: slope; bedrock at depth of 2 to 3½ feet; moderate to high shrink-swell potential.	Severe: slope; rockiness.	Moderate to severe: slope; rockiness.	Severe: rockiness; slope.	Severe: slope; rockiness; bedrock at depth of 2 to 3½ feet.	Moderate: rockiness; slope.
Severe: slope; bedrock at depth of 2 to 3½ feet; moderate to high shrink-swell potential.	Severe: slope; rockiness.	Severe: slope	Severe: rockiness; slope.	Severe: slope; rockiness; bedrock at depth of 2 to 3½ feet.	Severe: slope.
Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope	Moderate: slope	Moderate: slope; bedrock at depth of 2½ to 3½ feet.	Severe: bedrock at depth of 2½ to 3½ feet.	Slight.
Severe: slope; bedrock at depth of 2½ to 3½ feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at depth of 2½ to 3½ feet.	Moderate: slope.
Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: slope	Moderate: slope	Moderate: slope; bedrock at depth of 2 to 3½ feet.	Severe: bedrock at depth of 2 to 3½ feet.	Slight.
Severe: slope; bedrock at depth of 2 to 3½ feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at depth of 2 to 3½ feet.	Moderate: slope.
Severe: seasonal high water table.	Severe: wetness; very slow permeability.	Moderate: wetness.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Severe: poor traffic-supporting capacity; moderate to high shrink-swell potential.	Severe: slope	Moderate: slope	Moderate: slope: bedrock at depth of 2½ to 3½ feet.	Severe: slow permeability.	Slight.
Severe: slope; poor traffic-supporting capacity; moderate to high shrink-swell potential.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Moderate: slope.
Severe: slope; poor traffic-supporting capacity; moderate to high shrink-swell potential.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope.
Moderate: fair traffic-supporting capacity; seasonal high water table.	Moderate: slope; slow permeability.	Slight	Slight	Severe: slow permeability.	Slight.
Severe: seasonal high water table; flooding in some areas.	Moderate: wetness.	Moderate: wetness.	Moderate: seasonal high water table.	Severe: seasonal high water table; flooding in some areas.	Slight.
Severe: seasonal high water table; flooding in some areas.	Severe: wetness; very slow permeability.	Severe: wetness	Severe: seasonal high water table.	Severe: seasonal high water table; very slow permeability.	Severe: wetness.

TABLE 9.—*Degree and kind of limitations*

Soil series and map symbols	Septic tank filter fields	Sewage lagoons	Buildings with basements	Camp areas
*Muse:				
MsB	Severe: moderately slow permeability.	Moderate: slope	Moderate: medium to high compressibility; moderate to high shrink-swell potential.	Moderate: moderately slow permeability.
MsC	Severe: moderately slow permeability.	Severe: slope	Moderate: medium to high compressibility; moderate to high shrink-swell potential.	Moderate: slope; moderately slow permeability.
MsD	Severe: slope; moderately slow permeability.	Severe: slope	Moderate: slope; medium to high compressibility; moderate to high shrink-swell potential.	Severe: slope
MsE, MtF. For Trappist part of MtF, see Trappist series.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope
Pope:				
Po	Severe: flooding	Severe: flooding; moderately rapid permeability.	Severe: flooding	Moderate: flooding
Pp	Severe: flooding	Severe: flooding; moderately rapid permeability.	Severe: flooding	Moderate: flooding; coarse fragments.
Ramsey. Mapped only with with Steinsburg soils.	Severe: slope; bedrock at depth of 1 to 1½ feet.	Severe: slope; bedrock at depth of 1 to 1½ feet; rapid permeability.	Severe: slope; bedrock at depth of 1 to 1½ feet.	Severe: slope
Renox:				
ReB	Slight	Moderate: slope; moderately rapid permeability; coarse fragments.	Slight	Moderate: coarse fragments.
ReC	Moderate: slope	Severe: slope	Slight	Moderate: slope; coarse fragments.
*Rigley:				
RgB	Slight	Severe: slope; moderately rapid permeability.	Slight	Moderate: coarse fragments.
RgC	Moderate: slope	Severe: slope; moderately rapid permeability.	Slight	Moderate: slope; coarse fragments in some areas.
RgD, RoD	Severe: slope	Severe: slope; moderately rapid permeability.	Moderate: slope	Severe: slope
RgE, RlF, RoE, RoF. For Donahue part of RoD, see Donahue series unit DoD; for Donahue part of RoE and RoF, see Donahue series unit DoF.	Severe: slope	Severe: slope; moderately rapid permeability.	Severe: slope	Severe: slope; stoniness in some areas.
Shelocta. Mapped only with Latham soils.	Severe: slope	Severe: slope	Moderate to severe: slope.	Severe: slope

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Streets and low-cost roads	Playgrounds	Picnic areas	Lawns and landscaping	Cemeteries	Paths and trails
Moderate to severe: fair to poor traffic-supporting capacity; moderate to high shrink-swell potential.	Moderate: moderately slow permeability; slope.	Slight	Slight	Moderate: moderately slow permeability.	Slight.
Moderate to severe: fair to poor traffic-supporting capacity; moderate to high shrink-swell potential; slope.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: moderately slow permeability; slope.	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: flooding	Severe: flooding	Slight	Moderate: flooding.	Severe: flooding	Slight.
Severe: flooding	Severe: flooding; coarse fragments.	Moderate: coarse fragments.	Moderate: flooding.	Severe: flooding	Moderate: coarse fragments.
Severe: slope; bedrock at depth of 1 to 1½ feet.	Severe: slope; bedrock at depth of 1 to 1½ feet; rocky.	Severe: slope	Severe: slope; bedrock at depth of 1 to 1½ feet; rocky.	Severe: slope; bedrock at depth of 1 to 1½ feet; rocky.	Moderate to severe: slope.
Slight	Severe: coarse fragments.	Moderate: coarse fragments.	Slight	Slight	Moderate: coarse fragments.
Moderate: slope	Severe: coarse fragments; slope.	Moderate: slope; coarse fragments.	Moderate: slope.	Moderate: slope	Moderate: coarse fragments.
Slight	Severe: coarse fragments.	Moderate: coarse fragments.	Slight	Slight	Moderate: coarse fragments.
Moderate: slope	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments in some areas.	Moderate: slope	Moderate: slope	Moderate: coarse fragments.
Severe: slope	Severe: slope; coarse fragments.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; coarse fragments in some areas.
Severe: slope	Severe: slope; coarse fragments; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope; stoniness in some areas.	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate to severe: slope.

TABLE 9.—*Degree and kind of limitations*

Soil series and map symbols	Septic tank filter fields	Sewage lagoons	Buildings with basements	Camp areas
Skidmore: Sd	Severe: flooding	Severe: flooding; moderately rapid permeability.	Severe: flooding	Moderate: coarse fragments.
*Steinsburg: SrD	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; moderately rapid permeability; bedrock at depth of 2 to 3 feet.	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope
SrF. For Ramsey part, see Ramsey series.	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; moderately rapid permeability; bedrock at depth of 2 to 3 feet.	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope
Stendal: St	Severe: flooding; seasonal high water table.	Severe: flooding	Severe: flooding; seasonal high water table.	Moderate: flooding; seasonal high water table.
Stendal, neutral variant: Sv.	Severe: flooding; seasonal high water table.	Severe: flooding; moderately rapid permeability.	Severe: flooding; seasonal high water table.	Moderate: flooding; seasonal high water table.
Strip mines: Sx. Too variable to be rated.				
Tilsit: TlB	Severe: slow permeability; seasonal high water table.	Moderate: slope; ML and CL material.	Moderate: seasonal high water table; medium compressibility.	Moderate: slow permeability.
TlC	Severe: slow permeability; seasonal high water table.	Severe: slope	Moderate: seasonal high water table; medium compressibility.	Moderate: slope; slow permeability.
Trappist. Mapped only with Muse soils.	Severe: slope; moderately slow permeability; bedrock at depth of 2 to 3 feet.	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; bedrock at depth of 2 to 3 feet; high compressibility.	Severe: slope; stoniness.
Whitley: WhC	Moderate: slope; bedrock at depth of 3 to 5 feet.	Severe: slope; bedrock at depth of 3 to 5 feet.	Moderate: bedrock at depth of 3 to 5 feet; medium compressibility.	Moderate: slope
WhD	Severe: slope	Severe: slope; bedrock at depth of 3 to 5 feet.	Moderate: slope; bedrock at depth of 3 to 5 feet; medium compressibility.	Severe: slope
WtA	Slight	Moderate: moderate permeability.	Moderate: medium compressibility.	Slight
WtB	Slight	Moderate: slope; moderate permeability.	Moderate: medium compressibility.	Slight
WtC	Moderate: slope	Severe: slope	Moderate: medium compressibility.	Moderate: slope

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Streets and low-cost roads	Playgrounds	Picnic areas	Lawns and landscaping	Cemeteries	Paths and trails
Severe: flooding	Severe: flooding; coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Severe: flooding; coarse fragments.	Moderate: coarse fragments.
Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; rocky.	Moderate to severe: slope.	Severe: slope; rocky.	Severe: slope; bedrock at depth of 2 to 3 feet; rocky.	Moderate: slope.
Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; rocky.	Severe: slope	Severe: slope; rocky.	Severe: slope; bedrock at depth of 2 to 3 feet; rocky.	Severe: slope.
Severe: flooding; seasonal high water table.	Severe: flooding.	Moderate: wetness.	Severe: flooding.	Severe: flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: flooding; seasonal high water table.	Severe: flooding.	Moderate: wetness.	Severe: flooding.	Severe: flooding; seasonal high water table.	Moderate: seasonal high water table.
Moderate: seasonal high water table; fair traffic-supporting capacity.	Moderate: slope; slow permeability.	Slight	Slight	Severe: slow permeability.	Slight.
Moderate: slope; seasonal high water table; fair traffic-supporting capacity.	Moderate: slope; slow permeability.	Moderate: slope.	Moderate: slope.	Severe: slow permeability.	Slight.
Severe: slope; bedrock at depth of 2 to 3 feet; poor traffic-supporting capacity.	Severe: slope; stoniness.	Severe: slope	Severe: slope; stoniness.	Severe: slope; bedrock at depth of 2 to 3 feet; stoniness.	Severe: slope; stoniness.
Severe: bedrock at depth of 3 to 5 feet.	Severe: slope	Moderate: slope.	Moderate: slope.	Moderate: slope; bedrock at depth of 3 to 5 feet.	Slight.
Severe: slope; bedrock at depth of 3 to 5 feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: fair traffic-supporting capacity.	Slight	Slight	Slight	Slight	Slight.
Moderate: fair traffic-supporting capacity.	Moderate: slope	Slight	Slight	Slight	Slight.
Moderate: fair traffic-supporting capacity; slope.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope	Slight.

Septic tank filter fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage 2 to 5 feet deep long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope; and if the floor needs to be leveled, depth to and condition of bedrock become important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification system, and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Buildings, as rated in table 9, include dwellings and service buildings that have basements that are not more than three stories high, and that are placed in undisturbed soil. The features that affect the rating of a soil for dwellings and service buildings relate to capacity to support load and resist settlement under load and relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Streets and low-cost roads, as rated in table 9, have an all-weather surface that is expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil material at hand, and most cuts and fills are less than 6 feet deep.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic, but most of the vehicular traffic is confined to access roads. The best soils are firm when wet but not dusty when dry, are free from flooding during the season of use, and do not have slopes or stoniness that greatly increase the cost of leveling sites or of building access roads.

For lawns and landscaping, it is assumed that soil material at the site will be used. No importation of fill or topsoil is considered in the ratings. The ratings are based on depth to seasonal water table, slope, depth to bedrock, surface stoniness, surface rockiness, texture of the surface layer, and flooding hazard.

Cemeteries, as rated in table 9, are community-type cemeteries. It is assumed that soil material at the site will be used. No consideration is given to importation of fill or topsoil in the ratings. The soil features considered are depth to seasonal high water table, slope, permeability, depth to bedrock, surface rockiness, surface stoniness, surface soil texture, and hazard of flooding.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should be such as to require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Formation and Classification of the Soils

In this section the factors of soil formation and their relationship to the soils in the survey area are discussed. Then the soil series are placed in higher categories of the current system of classification and in the great groups of the old system.

Factors of Soil Formation [6]

Soil has been defined in many ways, but it is generally considered to be the collection of natural bodies on the earth's crust that commonly supports growing land plants. Soils are natural bodies in that they form by natural processes rather than by artificial means.

Soils vary in many respects, but all do have some factors in common. Every soil consists of mineral matter, organic mater, air, and water. The proportions of these components vary among soils and among horizons in a given soil. Every soil has length, breadth, and depth. Each has a more or less well-developed profile, which

[6] H. H. Bailey, associate professor of agronomy, University of Kentucky, assisted in preparing this section.

is a succesion of layers, called horizons, in a vertical section down into the underlying material. The nature of this profile is important to root growth, moisture storage, and storage of plant nutrients. The characteristics of the soil profile are also used in classifying the soil.

The soil profile is a record of the history of the soil. The soil as it is today is the product of the interaction of five soil-forming factors: (1) climate; (2) living organisms, chiefly vegetation; (3) parent material; (4) topography, or lay of the land; and (5) time. The interaction of the first four factors over a period of time determines the kind of soil found at any one place. These five factors are briefly discussed in the paragraphs that follow.

Climate

Climate is considered to be an active soil-forming factor. It affects the chemical, physical, and biological properties of a soil. The principal components of climate are precipitation and temperature. Precipitation and temperature influence vegetation, and, in turn, vegetation affects formation of soil. Climate affects the animals and micro-organisms that live in soil; influences weathering of rocks and minerals; and affects removal and deposition of materials by wind and water. The speed of chemical processes is also directly related to temperature and, in most cases, to water.

The climate of the survey area, which is temperate, has probably remained relatively constant for a very long time. Winters are fairly mild, and only for short periods is the temperature extremely low. The average temperature in January is 36.8° F. Periods of high temperature in summer are generally fairly short. The average temperature in July is 75.7°. The normal annual precipitation, which is 45.9 inches, is fairly well distributed throughout the year.

The soils of the area are moist and unfrozen most of the time and are subject to almost continuous leaching. Under these conditions soluble bases and clay minerals are carried from the surface layer into the subsoil by water percolating through the profile. This tends to produce acid soils, provided the bases leach or percolate completely through the soil. Also, clay minerals tend to accumulate in the subsoil. The result is an acid soil that has a moderate to high accumulation of clay in the subsoil. Whitley and Muse soils are examples.

A sloping soil is affected slightly, but significantly, by the direction of slope. Steep Rigley soils, for example, are darker colored in the surface layer on north-facing slopes than on south-facing slopes. This is because soils on north-facing slopes are cooler and more moist, so that more organic matter accumulates in the surface layer. A study of McCreary County, Kentucky, to the south of the survey area, found that 20 inches below the surface a north-facing soil was 3° cooler than a nearby south-facing soil. South-facing soils tend to be deeper, undergo more leaching, have a longer growing season, and have a greater tendency to summer drought than do comparable north-facing soils.

Living organisms

Living organisms, both plants and animals but mainly plants, are considered active soil-forming factors. They add organic matter to the soil and aid in soil formation and development. Plants bring nutrients from the lower part of the solum to the upper layers, produce channels through which air and water circulate, and improve soil structure. Animals and micro-organisms mix and decompose the organic matter, making plant nutrients available and generally improving the condition of the soil.

The native vegetation of the area was predominantly deciduous trees, mainly oaks, yellow-poplar, and hickories. Virginia, shortleaf, and pitch pine were common near cliffs and on narrow droughty ridges. The plants growing in an area affect the kind of soils formed. For example, the litter from pines decomposes to produce more organic acids than litter from hardwoods. Soils that developed under pines tend to be more highly leached than those that decomposed under hardwoods. For example, Steinsburg and Ramsey soils developed mostly under pines, and they have low natural fertility and low organic-matter content. On the other hand, Allegheny soils developed under hardwoods and have medium fertility and medium organic-matter content.

Forest litter reduces frost penetration and retards drying. The soils under trees, however, tend to be drier than adjacent soils in open fields, especially in summer, because of the continual removal of soil moisture by deep-rooted trees. Soils that have a dry profile, such as Ramsey and Berks soils, develop slowly.

In places man has also altered soil formation. His clearing of forests and planting of crops have reduced the annual natural addition of organic matter to the soil. In plowing, he mixes the upper horizons. When he has misused the land, accelerated erosion removes part or all of the desirable original surface layer and the less desirable subsoil is exposed.

Parent material

The degree of soil profile development depends on the length of time the parent material has been acted on by the climate and by living organisms. In the early stages of soil development, the characteristics of the soil are largely those inherited from its parent material. As more time passes the soil acquires characteristics of its own. The type of parent material, however, affects the texture and mineralogical properties of the soil.

The parent materials of the soils in the survey area are of three general types: (1) material that weathered in place from rocks similar to those of the present bedrock; (2) alluvium, both general alluvium that was deposited on flood plains by streams and local alluvium that was carried by water and gravity from adjacent hillsides and steep slopes and deposited at the base of the hills or in alluvial fans; and (3) colluvial material carried by gravity from ridges and upper side slopes and accumulated on benches and middle and lower side slopes.

The bedrock of the survey area is sedimentary and consists primarily of acid sandstone, shale, and siltstone. Some limestones and calcareous shales are present, mainly in southeastern Rowan County and in central Menifee County.

Soils, such as Berks soils, that developed in weathered siltstone are medium textured, contain many coarse fragments, and have weak horizon development. In contrast,

Latham soils developed in clay shale and have fine texture and clearly developed horizons.

Soils of the flood plains and stream terraces developed in general alluvium washed from upstream landforms. This alluvium is a mixture of materials that were sorted as they were deposited. The coarser materials were deposited near the stream channels and were the parent material of soils such as Pope and Allegheny soils. The fine-textured sediment settled in slower moving or still water and became the parent material of soils such as the Cuba, Morehead, and Whitley.

Material accumulated by gravity and water at the base of slopes and on fans is closely related to the soils and rocks on the slopes above. Cotaco and Renox soils developed in such material.

Most soils on the benches and lower one-half to two-thirds of the steep side slopes developed in gravity-carried colluvial material that is similar to the geological formations and the soils on the slopes above. Colluvial material is generally from two or more kinds of rock. Cranston soils formed in material from siltstone and shale; Rigley soils in material from sandstone, siltstone, and shale; and Brookside soils in material from limestone, shale, sandstone, and siltstone.

Topography

Topography, or lay of the land, influences soils chiefly by its effects on drainage and erosion, but also by the variations it causes in exposure to climate and the resulting differences in plant cover.

The shape of the land surface is generally related to the different rates of weathering of the underlying rocks. Shale weathers more rapidly than siltstone or sandstone; consequently, landscapes underlain by shale have a rounded, highly dissected appearance. When siltstone, sandstone, and shale are interbedded, the landscape has a benched appearance and more abrupt changes in slope.

Most steep soils are deep because they developed in deep colluvial material that has washed and crept downhill from ridges and very steep upper slopes and from cliffs. Examples are Rigley, Cranston, and Brookside soils. Some steep soils are moderately deep or shallow, particularly if very steep, largely because of rapid geologic erosion. Examples are Berks and Ramsey soils. Berks and Ramsey soils tend to have fewer and less distinct horizons than less steep soils. This is a result of water running off the surface and little water percolating through the profile. More rainfall penetrates less steep soils, and there is erosion.

Topography generally controls the water table. The water table is important in profile development. Soils that are saturated with water for extended periods reflect this saturation by the presence of mottling or graying of colors, or both. Examples are Mullins and Stendal soils.

Soils that formed in closely similar parent material but on different topographic positions also show a different internal drainage condition. Soils having this relationship form a drainage sequence, or catena. For example, well-drained Cuba soils, somewhat poorly drained Stendal soils, and poorly drained Bonnie soils form a catena of soils that formed in recent alluvium.

Time

Time is required for changes to take place in parent materials and for uniquely different kinds of soil to develop. The length of time required for soil development to take place in this survey area has been greatly influenced by the kind and nature of the parent materials and the topography. For example, the Steinsburg soils formed in residuum derived from resistant sandstone, and the Latham soils formed in residuum derived from easily weathered soft shale. The Latham soils have stronger horizon development than the Steinsburg soils.

More time is required for soils to form on steep landforms than on more nearly level landforms, because there is more runoff where slopes are steeper and less water moves through the parent material. Berks and Gilpin soils formed in the same kind of parent materials and for about the same length of time. The Gilpin soils formed on more nearly level landforms than the Berks soils and they have stronger horizon development than the Berks soils.

When soils begin to form they have characteristics almost identical to those of the parent material. Such soils are said to be immature, or youthful. Among the immature soils in the survey area are the Cuba and Clifty soils on flood plains. These soils formed in recent sediment and have weak horizon development; the surface layer shows a slight increase in content of organic matter, and the subsoil shows weak structure. After a long time, and if there is no further addition of sediment, weathering occurs, some of the finer material moves into the subsoil, and the structure and color of the subsoil change. Whitley soils are an example of these maturing actions.

A soil is generally said to be mature when it has been in place long enough to acquire distinct profile characteristics. Examples of mature soils in the survey area are Hartsells, Tilsit, and Latham soils.

Classification of the Soils

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*6*, *20*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 (*22*). The current system is under continual study (*19*). Therefore, readers interested in developments of this system should search available literature. In table 10 some of the classes in the current system and the great soil groups in the older system are given for each soil series in the survey area. The classes in the current system are briefly defind in the following paragraphs.

ORDER: In the orders of the current system of classification, soils are grouped according to common properties that seem to be the result of the same types of processes acting to about the same degree on parent material. Ten soil orders are recognized in the current system. Each order is named with a word of three or four syllables ending in *sol.*

As shown in table 10, there are four soil orders in the survey area. They are Entisols, Inceptisols, Ultisols, and Alfisols. Entisols lack pedogenic horizons. Inceptisols are usually moist and have altered pedogenic hori-

zons. Ultisols are highly developed but still contain some weatherable minerals. Alfisols have a clay-enriched B horizon that is high in base saturation.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol). The suborder is not shown in table 10, since it is indicated in the last word of the subgroup name.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Hapludult* (*Hapl*, meaning minimum). The great group is not shown separately in table 10, because it is the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups, one that represents the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properites of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of a great group. An example is *Typic Hapludult* (a typical Hapludult). Table 10 shows the name of the subgroup for each soil series recognized in the survey area.

FAMILY: Each subgroup is divided into families, primarily on the basis of properties important to plant growth. Some of the properties considered are texture, mineralogy, reaction, soil temperature, permability, consistence, and thickness of horizons. A family name con-

TABLE 10.—*Classification of soil series by higher categories*

Series	Family	Subgroup	Order	Great soil group (1938 classification)
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides intergrading to Lithosols.
Bonnie	Fine-silty, mixed, acid, mesic	Typic Fluvaquents	Entisols	Alluvial soils.
Brookside	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Chavies, acid variant.	Coarse-loamy, siliceous, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading to Alluvial soils.
Clifty	Fine-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Cotaco, neutral variant.	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading to Alluvial soils.
Cranston	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Cuba	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Donahue	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Hartsells [1]	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Johnsburg [2]	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols	Planosols.
Latham	Clayey, mixed, mesic	Aquic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.
Monongahela	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils.
Morehead	Fine-silty, mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Mullins	Fine-silty, mixed, mesic	Typic Fragiaquults	Ultisols	Planosols.
Muse	Clayey, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Pope	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Ramsey	Loamy, siliceous, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols.
Renox	Fine-loamy, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Rigley	Coarse-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Shelocta	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Skidmore	Loamy-skeletal, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Steinsburg	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Stendal	Fine-silty, mixed, acid, mesic	Aeric Fluvaquents	Entisols	Alluvial soils.
Stendal, neutral variant.	Coarse-loamy, mixed, nonacid, mesic.	Aeric Fluvaquents	Entisols	Alluvial soils.
Tilsit	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils.
Trappist	Clayey, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Whitley	Fine-silty, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.

[1] The Hartsells soils are in the mesic temperature zone, but they are near the line between mesic and thermic.

[2] Johnsburg soils in this survey area have a yellower hue in the B horizon, except in the B32 horizon, and are grayer in the lower part of the fragipan and B31g horizon than is defined as within the range of the series.

sists of a series of adjectives describing certain properties used as family differentiae (texture, mineralogy, and the like). This classification of each soil series is shown in table 10.

SERIES: A series consists of a group of soils that formed from a particular type of parent material. It has genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

Laboratory Data [7]

As part of this soil survey, samples from selected soils were analyzed by the Kentucky Agricultural Experiment Station. These profiles are representative of their respective series and are described in the section, "Descriptions of the Soils."

Early in mapping it became evident that there were differences between two steep soils that formed in deep colluvium derived from acid siltstone and shale. Prior mapping procedures had included both soils, one from Pennsylvanian rocks and the other from Mississippian rocks, in one soil series. The observations made during mapping indicated that these soils, occurring on two different geologic formations, had different color, texture, and landform. As an outgrowth of these observations, representative profiles from each geologic area were analyzed to determine the chemical and physical characteristics of the soils that are important to their classification.

[7] H. H. BAILEY, associate professor of agronomy, University of Kentucky, assisted in preparing this section.

The results of these analyses are shown in table 11. The data in this table are useful in classifying soils and developing concepts of soil genesis. They confirm the classification of the Shelocta and Cranston soils in this survey area. The data are also helpful in estimating available water capacity, fertility, productivity, and other aspects of soil management.

Samples and descriptions of each horizon of the soils that were studied were obtained from profiles exposed in specially dug pits. Results reported in table 11 are averages of duplicate determinations using air-dry soil. All analyses were on material finer than 2 millimeters. The methods of Kilmer and Alexander were used for organic-matter removal and pipette mechanical analysis (*9*). Material coarser than 2 millimeters was determined by field estimation and is reported by volume. Soil reaction was determined by the glass electrode method using a 1:1 soil-water suspension. A method adapted from Peech et al. (*14*), was followed in the determination of cation-exchange capacity of whole soils, except that replaced ammonium ions were determined by distillation and titration. A Perkin-Elmer 303 atomic absorption spectrophotometer [8] was used to determine magnesium and sodium in solutions extracted from soil with neutral normal ammonium acetate. A Technicon Auto-Analyzer flame photometer was used for calcium and potassium determinations in the same extractants. Organic matter was determined by modification of the method of Walkley and Black (*24*). Base saturation was obtained by dividing the sum of bases (Ca, Mg, K, and Na) by the cation exchange capacity and multiplying by 100.

[8] Trade and company names are included for the specific information of the reader and do not imply any endorsement by the United States Department of Agriculture.

TABLE 11.—*Physical and chemical*

[Analyses by Kentucky Agricultural

Soil name and location	Horizon	Depth from surface	Particle-size distribution: Larger than 2 millimeters	Very coarse sand to fine sand (2 mm-0.1 mm)	Very fine sand (0.1 mm-0.05 mm)
		Inches	*Percent*	*Percent*	*Percent*
Cranston gravelly silt loam: Three miles north of Poppin Rock Tunnel at Paragon on State Route 519, 300 yards east in a ravine, Rowan County. Laboratory No. S67Ky-103-1.	A1	0-5	25	4. 7	19. 3
	B1	5-13	20	5. 0	17. 6
	B21t	13-23	30	5. 4	17. 4
	B22t	23-31	15	4. 2	15. 3
	B3t	31-50	15	3. 6	16. 6
	C	50-76	23	3. 6	15. 6
Shelocta silt loam: About 4 miles southeast of the North Fork of the Licking River on State Route 1378, then 200 yards north, Morgan County. Laboratory No. S67Ky-88-8.	Ap1	0-2	3	12. 9	8. 9
	Ap2	2-8	5	14. 1	8. 8
	B1t	8-14	5	8. 9	7. 1
	B21t	14-26	10	8. 8	6. 3
	B22t	26-36	8	6. 2	5. 4
	B3t	36-47	10	5. 6	4. 8
	C	47-64	30	1. 4	1. 9

[1] Trace.

General Nature of the Area

This section provides general information about Menifee and Rowan Counties and Northwestern Morgan County. It briefly tells about history, climate, physiography and geology, relief and drainage, and resources.

Menifee County was established in 1869. Its population, according to the 1960 census, was 4,276, which was 10.9 percent less than the population in 1950. Menifee County has no urban centers.

Rowan County was established in 1856. Its population in 1960 was 12,808, which was 0.8 percent more than the population in 1950. Rowan County has an urban population of 4,170, a rural nonfarm population of 5,767, and a rural farm population of 2,871.

Morehead State University was founded in 1922 and has 365 acres in and near Morehead. Its physical plant consists of more than 40 major structures, and its enrollment is about 6,000. The university contributes significantly to the cultural environment and economy of Morehead and of Rowan Counties.

Climate [9]

The climate in Menifee and Rowan Counties and Northwestern Morgan County is temperate. Winters are moderately cold, and summers are warm and humid. Temperature, rainfall, and humidity remain within limits agreeable to man and are suitable for varied plant and animal life. All seasons are marked by weather changes that come from passing weather fronts and associated centers of high and low pressure. This activity is least late in spring and in summer, somewhat greater in fall, and greatest in winter and early in spring. Temperatures depart from the average least during the period of least activity and vary from the average most during the period of greatest activity. Tables 12 and 13 give climatic data. All temperatures are based on those in a standard National Weather Service thermometer shelter at a height of approximately 5 feet above the ground in a representative exposure. Temperatures at times will be lower nearer the ground or in local areas subject to extreme air drainage. There may be at times considerable variation in temperature in hilly areas some distance from the station.

Precipitation is fairly well distributed throughout the year, and there are no wet or dry seasons. October has the least rainfall, and July has the most. Annual free-water evaporation from shallow lakes and farm ponds averages about 35 inches, which is about 11 inches less than the average annual precipitation. About 74 percent of the evaporation occurs from May to October.

Snowfall is quite variable from year to year, and some winters have relatively little. The greatest annual total recorded for the period of this summary was 44.9 inches in 1960; the least recorded was 3.6 inches in 1949. Thunderstorms occur an average of about 46 days each year. They are most frequent in spring and summer but can occur in any month. They cause most of the short-duration, high-intensity rainfall.

The growing season for plants that are killed by a temperature of 32° F averages 166 days. The season is 187 days or more in 10 percent of the years, 177 days or more in 25 percent, 155 days or more in 75 percent, and 145 days or more in 90 percent.

[9] By Alan B. Elam, Jr., climatologist for Kentucky, National Weather Service, U.S. Department of Commerce.

characteristics of two selected soils

Experiment Station, Lexington]

Particle-size distribution—Continued			Reaction	Organic matter	Cation exchange capacity	Extractable cations (milliequivalent per 100 grams of soil)				Sum of bases	Base saturation
Sand (2 mm-0.05 mm)	Silt (0.05 mm-0.002 mm)	Clay (less than 0.002 mm)				Ca	Mg	K	Na		
Percent	*Percent*	*Percent*	*pH*	*Percent*	*Meq/100g*						*Percent*
24. 0	67. 4	8. 6	5. 8	3. 81	7. 8	3. 2	1. 0	. 3	. 1	4. 6	59
22. 6	68. 7	8. 7	5. 0	1. 31	4. 4	. 4	. 2	. 2	. 1	. 9	20
22. 8	68. 6	8. 6	5. 4	. 50	4. 2	. 6	. 8	. 2	(1)	1. 6	38
19. 5	68. 9	11. 6	5. 4	. 37	6. 3	. 7	1. 2	. 2	. 1	2. 2	35
20. 2	67. 0	12. 8	5. 2	. 22	7. 0	1. 0	1. 6	. 2	. 1	2. 9	41
19. 2	67. 3	13. 5	5. 5	. 24	6. 6	1. 8	2. 6	. 2	. 1	4. 7	71
21. 8	57. 7	20. 5	5. 5	4. 97	10. 9	5. 8	0. 8	0. 4	(1)	7. 0	64
22. 9	56. 0	21. 1	5. 0	2. 87	8. 7	1. 9	. 4	. 3	(1)	2. 6	30
16. 0	55. 5	28. 5	4. 7	. 78	7. 3	2. 2	. 5	. 3	(1)	3. 0	41
15. 1	56. 5	28. 4	4. 3	. 29	7. 8	1. 2	. 7	. 3	(1)	2. 2	28
11. 6	59. 8	28. 6	4. 1	. 35	8. 4	. 7	. 8	. 2	(1)	1. 7	20
10. 4	58. 5	31. 1	4. 0	. 32	9. 2	. 2	. 9	. 2	0. 1	1. 4	15
3. 3	65. 2	31. 5	3. 8	. 30	16. 4	. 2	2. 1	. 4	. 1	2. 8	17

TABLE 12.—*Temperature and precipitation data*

[Data from Farmers, Rowan County, 1931–60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly maximum	Average monthly minimum	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with 1.0 inch or more of snow	Average depth of snow on days with snow cover
	°F	°F	°F	°F	Inches	Inches	Inches	Number	Inches
January	47	25	67	2	4.5	1.7	8.1	7	3
February	50	26	69	4	3.6	1.3	6.3	4	3
March	58	32	77	13	4.6	2.3	7.4	2	4
April	69	41	86	24	3.9	1.9	6.2	1	1
May	79	50	90	35	4.1	2.2	6.4	0	0
June	86	59	95	44	4.5	1.8	7.7	0	0
July	89	63	97	50	4.8	2.5	7.7	0	0
August	88	61	96	48	4.1	1.5	7.1	0	0
September	83	54	94	38	3.1	1.3	5.2	0	0
October	72	42	85	25	2.3	.8	3.8	0	0
November	58	32	78	14	3.2	1.3	5.3	1	3
December	48	26	67	6	3.2	1.5	5.2	3	3
Year	69	43	[1] 98	[2] 5	45.9	37.8	54.6	18	3

[1] Average annual maximum.
[2] Average annual minimum.

TABLE 13.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from Farmers, Rowan County]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 29	April 3	April 17	May 1	May 13
2 years in 10 later than	March 21	March 27	April 11	April 25	May 8
5 years in 10 later than	March 7	March 15	March 30	April 14	April 28
Fall:					
1 year in 10 earlier than	November 11	October 27	October 17	October 7	September 26
2 years in 10 earlier than	November 16	November 2	October 23	October 13	October 1
5 years in 10 earlier than	November 26	November 12	November 2	October 22	October 11

Physiography and Geology

Nearly all of the survey area is in the Mountains and Eastern Coal Fields physiographic region (*11*). The western tip of Rowan County is in the Knobs region. The survey area is underlain by different layers of sedimentary rocks that dip gently to the southeast. Rocks of four different ages are exposed in the survey area; in chronological order from the youngest to the oldest, they are Pennsylvanian, Mississippian, Devonian, and Silurian.

The Pennsylvanian rocks cover most of Morgan County except for some deep valleys near the Licking River, and they cap ridges and upper side slopes in the eastern half of Menifee and Rowan Counties. Thes rocks are acid sandstone, shale, and some siltstone in alternating layers. The Rockcastle Sandstone is the oldest Pennsylvanian rock. It forms a giant cliff, known as the Pottsville escarpment, that extends through the middle of the survey area. Most soils that developed in material weathered from these formations are loamy, very strongly acid, and low in fertility.

The Mississippian rocks cover most of Rowan and Menifee Counties and the deep valleys on the western edge of Morgan County. These rocks are mostly evenly bedded, acid siltstones that have shale and limestone partings. Some shales and siltstones are calcareous, and some shales are argillaceous. The upper part is largely limestone, which forms a discontinuous cliff in many places and caps ridges. These limestone formations greatly affect the reaction and fertility of the soils that form from them.

The Devonian and Silurian rocks crop out only in the southwestern edge of Rowan County and make up

less than 3 percent of the surface of the survey area. The soils that formed from Devonian and Silurian rocks generally are clayey, are strongly acid, and have medium fertility.

The kind of surface rock greatly influences the kinds of soil that form, particularly with respect to residual soils (fig. 13). In general, shale is soft and easily weathered into moderately deep to deep, clayey soils. Sandstone is resistant to weathering and tends to form shallow, sandy soils. Siltstone is also resistant and tends to form shallow, loamy soils that have high content of coarse fragments. Soils formed in limestone are generally high in clay, sticky, and very plastic. Soils formed in colluvium or alluvium from two or more kinds of rock exhibit characteristics derived from the combination.

Relief and Drainage

The survey area consists of a maturely dissected plateau that has variable relief, creating a range of low mountains. Narrow winding ridges, steep valley walls, and narrow bottoms characterize the area. Most soils on the side slopes formed in colluvium of variable thickness that overlies alternate layers of resistant and nonresistant rocks. This generally creates complex, benchy side slopes. The young alluvium on flat valley bottoms is underlain by resistant rocks. Soils on ridgetops formed in residuum weathered from the underlying bedrock.

Elevations range from about 690 feet above sea level along the Licking River to about 1,450 feet in northern Rowan County. The average elevation of the plateau ridgetops is about 1,100 feet. Most streams run at about 800 feet above sea level.

Most of the survey area is in the Licking River watershed; the southern part of Menifee County, however, is in the Red River watershed. The Licking River flows northwest through the middle of the survey area, and the larger tributary streams drain into it from the northeast or southwest. The Red River forms part of the southern boundary of Menifee County and flows west. Tributary streams in the southern part of Menifee County flow south into the Red River. This dendritic stream pattern is a result of the shale and siltstone strata that predominate in the survey area.

In much of the western part of the survey area, the valleys are flat and broad and are characterized by steep, dissected lower hillsides. The streams are often dry in summer, and they have relatively small beds. However, the streams have fairly large watersheds and broad flood plains and terraces. Ridges are rounded and narrow, and the soils on the ridges are well drained to excessively drained.

The Pottsville escarpment extends northeast-southwest through the survey area and creates a belt of rugged topography. This area is characterized by a hillside that has a large cliff of sandstone on the upper part and steep, stony soils below the cliff. The streams and valley bottoms are similar to those in the western part of the survey area except that some, such as Craney Creek, run during summer. In this area the ridges are broad and flat and the side slopes above the cliff are short and rounded. Soils on the ridges are generally deep and well drained.

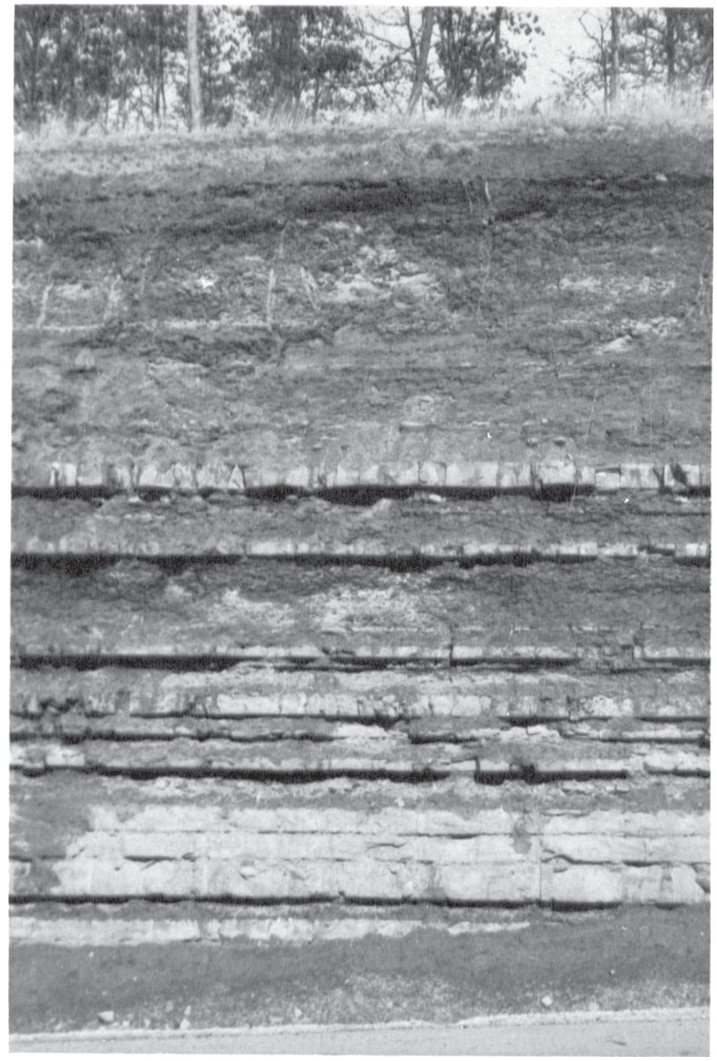

***Figure 13.*—Latham silt loam overlying interlayered acid shale and siltstone, which dominate the surface geology in the survey area. The layers of shale and siltstone vary considerably in thickness. The Latham soils formed in the shale layers.**

Much of the survey area east of the Pottsville escarpment consists of rounded, wide ridges and steep, benchy side slopes. There are several broad valley bottoms along the Licking River and large tributaries, but most valleys are narrow and V-shaped. The drainage pattern is highly dendritic and is more branched than in the western part of the survey area.

The drainage system consists of several rivers and long streams with perennially running water and numerous short streams and branches with intermittent waterflow. On their dissecting routes to larger streams, the short intermittent branches in many places form alluvial fans that protrude into the bottoms or terraces. Some branches lack a stream channel, which prevents good drainage and generally creates wet soils and seeps on the fans and nearby bottom soils. Most of the soils on high terraces in the area have a fragipan and are

poorly drained to moderately well drained. Ponding of water on the surface is common in this area, as are seeps.

Springs and seeps commonly are at the base of sandstone cliffs and in limestone formations. Some springs or seeps are on sloping to moderately steep colluvial toe slopes that grade into nearly level terraces that have soils with a fragipan. In these cases the soils on the toe slopes are not well drained.

Resources

About 76 percent of Rowan County and 81 percent of Menifee County are forested. In 1963 the Forest Service estimated the total volume of saw timber in Rowan County to be 274 million board feet of hardwood and 42 million board feet of softwood. Estimates for Menifee County were 221 million board feet of hardwood and 52 million board feet of softwood. About 4.5 million cubic feet of forest products was harvested in Menifee and Rowan Counties in 1962 (*13*). This was mostly hardwood sawlogs and some softwood sawlogs and pulpwood. In 1962, 6 sawmills were active in Rowan County and 13 in Menifee County (*8*).

About 1,300 farms are in the area, and the average size is about 108 acres. Tobacco, corn, and hay are the main crops, and beef cattle and hogs are the main livestock. About 640 acres of tobacco is grown in Rowan County and 568 acres in Menifee County. Rowan County raises 2,068 acres of corn, and Menifee County 1,100 acres. Rowan County produces 5,700 acres of hay, and Menifee County 2,900 acres. In 1964 about 6,000 head of cattle and 1,400 head of hogs were reported in Rowan County, and 3,300 head of cattle and 780 head of hogs in Menifee County. Between 1959 and 1964 the number of cattle in Menifee and Rowan Counties increased considerably, and the number of hogs and the acreage of corn decreased.

About one-third of the farm operators in the area are part-time farmers, and about one-half of the farms have other income that exceeds the value of farm products sold.

Fire clay and limestone are mined in the area. Limestone production is variable because its primary use is for road stone. Some limestone is produced for agricultural lime, and some limestone on Clack Mountain in Rowan County is produced for use in steel mills.

About two-thirds of the water used by the people of the survey area comes from surface sources, and the remaining one-third from wells. The city of Morehead receives its water from the Licking River. Triplett Creek and Red River are also good sources of water.

Most farms and rural communities obtain their water from wells. Most wells in valley bottoms yield 100 to 500 gallons of water per day. Wells on hillsides generally yield less water, and some wells on sides of Mississippian siltstone and shale hills yield little or no water. Generally, water from wells is soft.

The Cave Run Reservoir is a manmade body of water impounded behind a recently constructed dam on the Licking River in Bath and Rowan Counties. It covers about 8,270 acres, 4,360 of which is in the survey area. This reservoir offers a wide variety of recreational activities, including swimming, fishing, water skiing, and boating. Because of the reservoir and the expanded facilities of the Daniel Boone National Forest, recreation and tourism promise to be important future sources of income in the area.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bottom land. Lowland formed by alluvial deposit along a stream or in a lake basin; a flood plain.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Drainage, surface. Runoff, or surface flow, of water from an area.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Leaching. The removal of soluble material from soils or other material by percolating water.

Loam. Soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Natural fertility. The ability of a soil to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil, are favorable. Relative terms used to describe natural fertility are *high*, *medium*, and *low*.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Residuum. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residuum is not soil but is frequently the material in which soil has formed.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Second bottom. The first terrace above the normal flood plain of a stream.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope. The amount of rise or fall in feet in each 100 feet of horizontal distance. It is normally expressed as a percentage. The terms used in this survey are: *Nearly level,* 0 to 2 percent slopes; *gently sloping,* 2 to 6 percent slopes; *sloping,* 6 to 12 percent slopes; *strongly sloping,* 12 to 20 percent slopes; *moderately steep,* 20 to 30 percent slopes; *steep,* 30 to 50 percent slopes; and *very steep,* more than 50 percent slopes.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil depth. The thickness of the solum, or soil proper, as distinguished from the C horizon or R layer of the profile. It is normally expressed in inches. The terms used in this survey are: *Shallow,* 10 to 20 inches; *moderately deep,* 20 to 40 inches; and *deep,* more than 40 inches.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The reative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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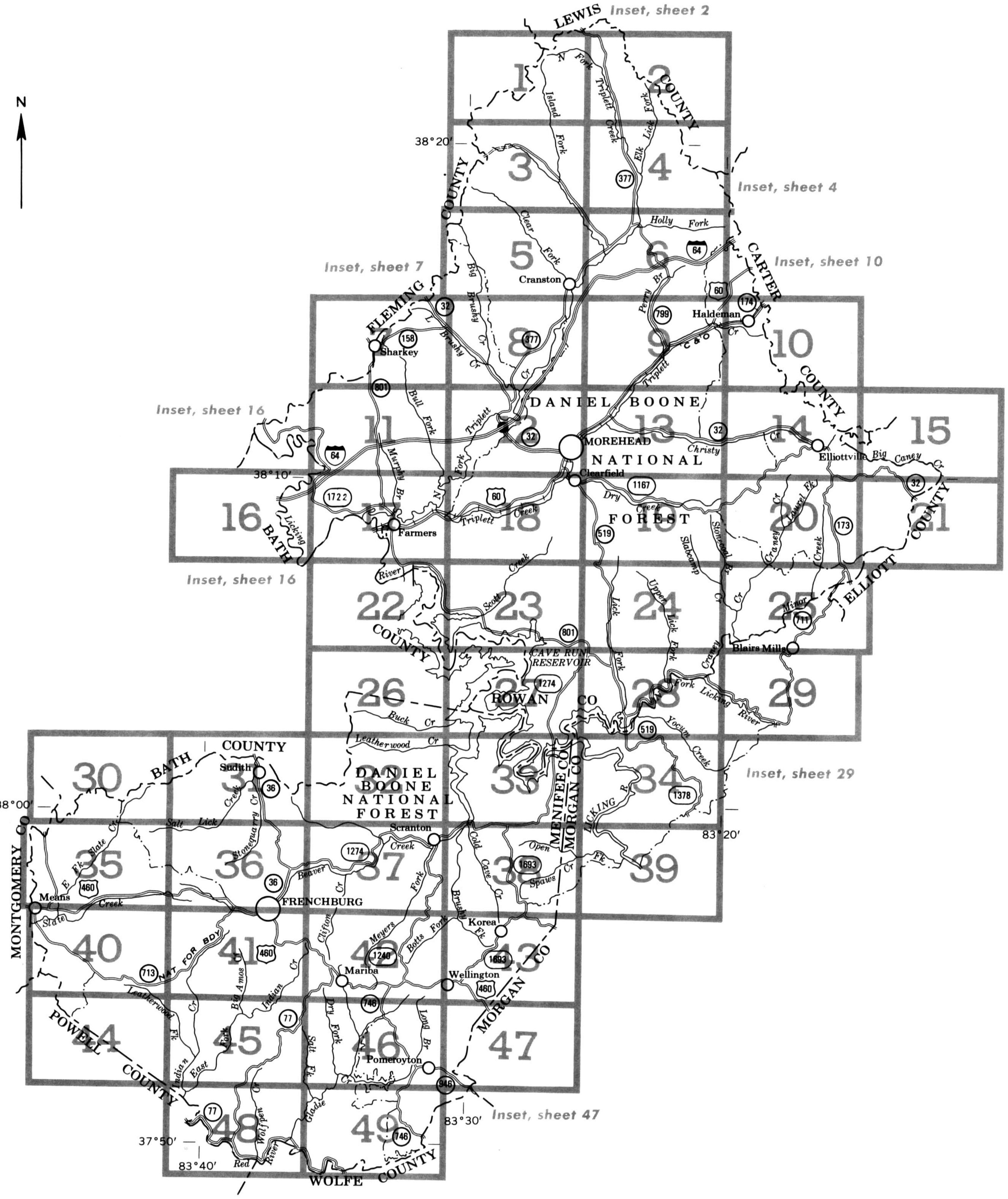


INDEX TO MAP SHEETS

MENIFEE AND ROWAN COUNTIES AND
NORTHWESTERN MORGAN COUNTY, KENTUCKY

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope.

SYMBOL	NAME
AlB	Allegheny loam, 2 to 6 percent slopes
AlC	Allegheny loam, 6 to 12 percent slopes
AlD	Allegheny loam, 12 to 20 percent slopes
BeF	Berks silt loam, 40 to 70 percent slopes
Bo	Bonnie silt loam
BrF	Brookside stony silt loam, 30 to 60 percent slopes
ChB	Chavies fine sandy loam, acid variant, 0 to 6 percent slopes
Ck	Clifty silt loam
CoB	Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes
CrB	Cranston gravelly silt loam, 2 to 6 percent slopes
CrC	Cranston gravelly silt loam, 6 to 12 percent slopes
CrD	Cranston gravelly silt loam, 12 to 20 percent slopes
CrE	Cranston gravelly silt loam, 20 to 30 percent slopes
CrF	Cranston gravelly silt loam, 30 to 60 percent slopes
Cu	Cuba silt loam
DoD	Donahue rocky sandy loam, 6 to 20 percent slopes
DoF	Donahue rocky sandy loam, 20 to 40 percent slopes
GlC	Gilpin silt loam, 6 to 12 percent slopes
GlD	Gilpin silt loam, 12 to 20 percent slopes
HaC	Hartsells fine sandy loam, 6 to 12 percent slopes
HaD	Hartsells fine sandy loam, 12 to 20 percent slopes
Jo	Johnsburg silt loam
LaC	Latham silt loam, 6 to 12 percent slopes
LaD	Latham silt loam, 12 to 20 percent slopes
LaE	Latham silt loam, 20 to 30 percent slopes
LsD	Latham-Shelocta silt loams, 12 to 20 percent slopes
LsE	Latham-Shelocta silt loams, 20 to 30 percent slopes
LsF	Latham-Shelocta silt loams, 30 to 50 percent slopes
MoB	Monongahela fine sandy loam, 2 to 6 percent slopes
Mp	Morehead silt loam
Mr	Mullins silt loam
MsB	Muse silt loam, 2 to 6 percent slopes
MsC	Muse silt loam, 6 to 12 percent slopes
MsD	Muse silt loam, 12 to 20 percent slopes
MsE	Muse silt loam, 20 to 30 percent slopes
MtF	Muse-Trappist stony silt loams, 30 to 60 percent slopes
Po	Pope fine sandy loam
Pp	Pope gravelly fine sandy loam
ReB	Renox gravelly fine sandy loam, 2 to 6 percent slopes
ReC	Renox gravelly fine sandy loam, 6 to 15 percent slopes
RgB	Rigley gravelly fine sandy loam, 2 to 6 percent slopes
RgC	Rigley gravelly fine sandy loam, 6 to 12 percent slopes
RgD	Rigley gravelly fine sandy loam, 12 to 20 percent slopes
RgE	Rigley gravelly fine sandy loam, 20 to 30 percent slopes
RlF	Rigley stony fine sandy loam, 30 to 60 percent slopes
RoD	Rigley-Donahue complex, 6 to 20 percent slopes
RoE	Rigley-Donahue complex, 20 to 30 percent slopes
RoF	Rigley-Donahue complex, 30 to 60 percent slopes
Sd	Skidmore gravelly fine sandy loam
SrD	Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes
SrF	Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes
St	Stendal silt loam
Sv	Stendal fine sandy loam, neutral variant
Sx	Strip mines
TlB	Tilsit silt loam, 2 to 6 percent slopes
TlC	Tilsit silt loam, 6 to 12 percent slopes
WhC	Whitley silt loam, 6 to 12 percent slopes
WhD	Whitley silt loam, 12 to 20 percent slopes
WtA	Whitley silt loam, terrace, 0 to 2 percent slopes
WtB	Whitley silt loam, terrace, 2 to 6 percent slopes
WtC	Whitley silt loam, terrace, 6 to 12 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

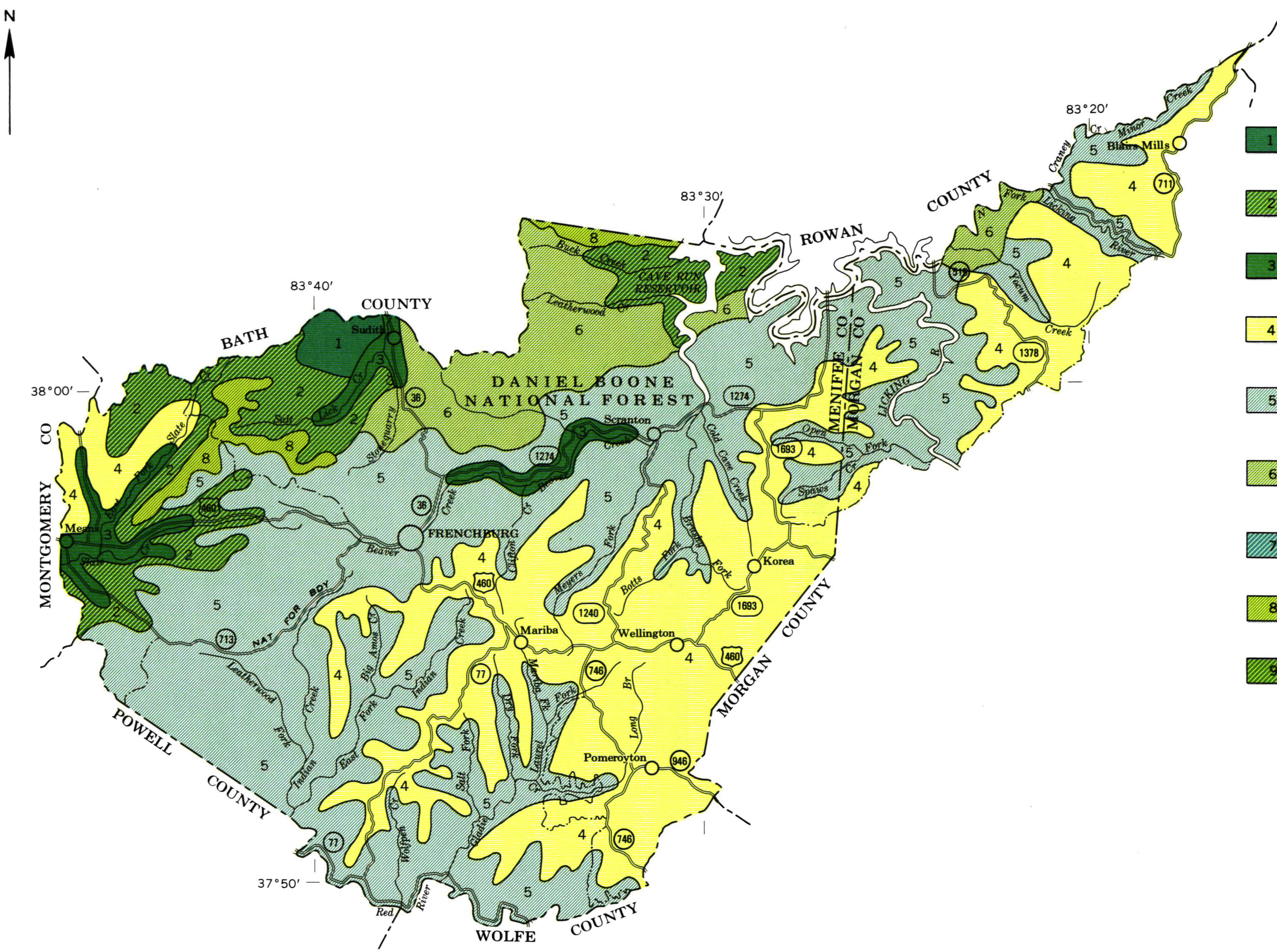
Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully



SOIL ASSOCIATIONS

1. Cranston-Berks association: Deep and moderately deep, well-drained, dominantly steep and very steep soils that formed in material weathered from siltstone and shale; on side slopes of narrow ridges
2. Berks-Cranston-Latham association: Moderately deep and deep, well drained and moderately well drained, sloping to very steep soils that formed in material weathered from siltstone and shale; on side slopes and moderately wide ridgetops
3. Tilsit-Clifty-Morehead association: Deep, somewhat poorly drained to well-drained, nearly level to sloping soils that formed in material weathered from siltstone, shale, and sandstone; on bottoms and stream terraces
4. Latham-Shelocta association: Moderately deep and deep, moderately well drained and well drained, sloping to steep soils that formed in material weathered from shale and siltstone; on smooth, short side slopes, toe slopes, and moderately wide ridgetops
5. Rigley-Brookside-Steinsburg association: Deep and moderately deep, well-drained, sloping to very steep soils that formed in material weathered from shale, limestone, or sandstone; on narrow ridgetops and side slopes
6. Rigley-Cranston-Steinsburg association: Deep and moderately deep, well-drained, gently sloping to very steep soils that formed in material weathered from sandstone, siltstone, and shale; on moderately wide ridgetops, side slopes, and toe slopes
7. Latham-Tilsit-Johnsburg association: Moderately deep and deep, moderately well drained and somewhat poorly drained, nearly level to strongly sloping soils that formed in material weathered from shale and siltstone; on broad ridgetops
8. Donahue-Latham association: Moderately deep, well drained and moderately well drained, sloping to steep soils that formed in material weathered from limestone or clay shale; on ridgetops and side slopes
9. Muse-Trappist-Latham association: Deep and moderately deep, well drained and moderately well drained, gently sloping to very steep soils that formed in material weathered from shale; on side slopes, toe slopes, and narrow ridgetops

Compiled 1972

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

KENTUCKY AGRICULTURAL EXPERIMENT STATION

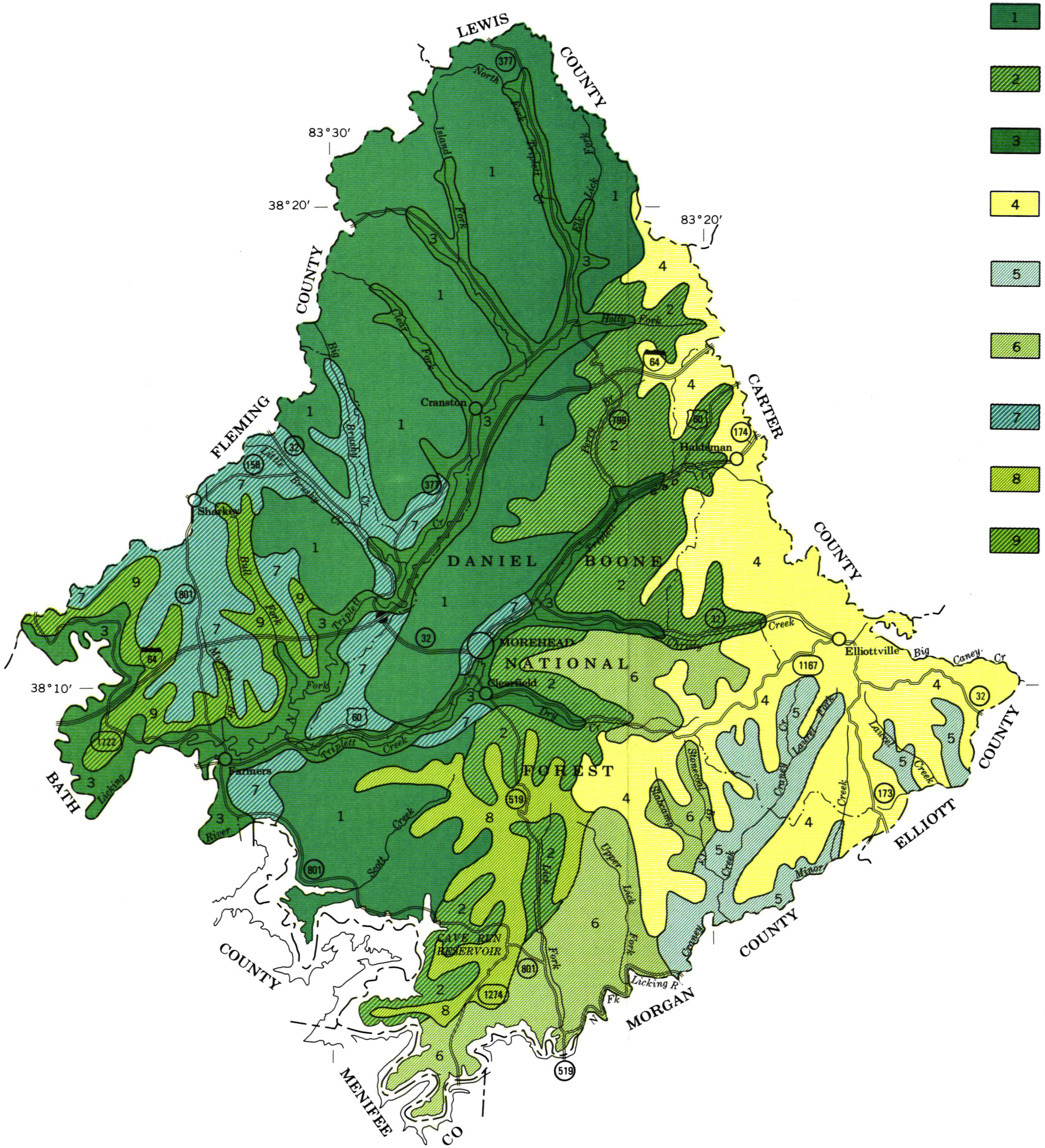
GENERAL SOIL MAP

MENIFEE COUNTY AND NORTHWESTERN MORGAN COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SOIL ASSOCIATIONS

1	Cranston-Berks association: Deep and moderately deep, well-drained, dominantly steep and very steep soils that formed in material weathered from siltstone and shale; on side slopes of narrow ridges
2	Berks-Cranston-Latham association: Moderately deep and deep, well drained and moderately well drained, sloping to very steep soils that formed in material weathered from siltstone and shale; on side slopes and moderately wide ridgetops
3	Tilsit-Clifty-Morehead association: Deep, somewhat poorly drained to well-drained, nearly level to sloping soils that formed in material weathered from siltstone, shale, and sandstone; on bottoms and stream terraces
4	Latham-Shelocta association: Moderately deep and deep, moderately well drained and well drained, sloping to steep soils that formed in material weathered from shale and siltstone; on smooth, short side slopes, toe slopes, and moderately wide ridgetops
5	Rigley-Brookside-Steinsburg association: Deep and moderately deep, well-drained, sloping to very steep soils that formed in material weathered from shale, limestone, or sandstone; on narrow ridgetops and side slopes
6	Rigley-Cranston-Steinsburg association: Deep and moderately deep, well-drained, gently sloping to very steep soils that formed in material weathered from sandstone, siltstone, and shale; on moderately wide ridgetops, side slopes, and toe slopes
7	Latham-Tilsit-Johnsburg association: Moderately deep and deep, moderately well drained and somewhat poorly drained, nearly level to strongly sloping soils that formed in material weathered from shale and siltstone; on broad ridgetops
8	Donahue-Latham association: Moderately deep, well drained and moderately well drained, sloping to steep soils that formed in material weathered from limestone or clay shale; on ridgetops and side slopes
9	Muse-Trappist-Latham association: Deep and moderately deep, well drained and moderately well drained, gently sloping to very steep soils that formed in material weathered from shale; on side slopes, toe slopes, and narrow ridgetops

Compiled 1972

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

KENTUCKY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

ROWAN COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Acreage and extent, table 1, page 12.
Estimated yields, table 3, page 47.
Suitability of the soils for elements of wildlife habitat and kinds of wildlife, table 4, page 50.
Engineering uses of the soils, table 5, page 52, table 6, page 54, and table 7, page 58.
Interpretations for watershed management, table 8, page 68.
Interpretations for town and country planning, table 9, page 70.

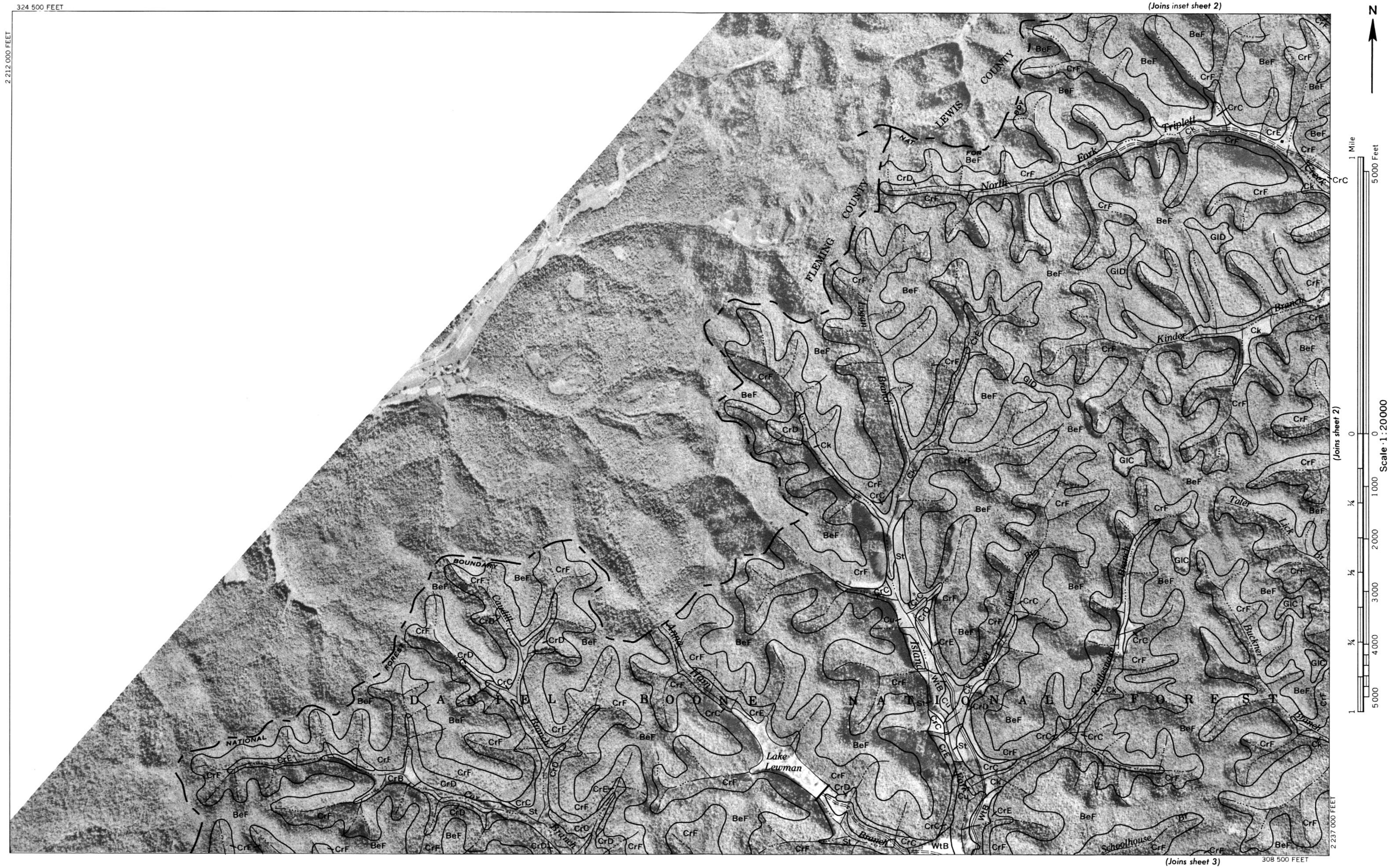
Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Woodland suitability group Symbol	Wildlife group Number
AlB	Allegheny loam, 2 to 6 percent slopes	13	IIe-1	41	2o1	1
AlC	Allegheny loam, 6 to 12 percent slopes	13	IIIe-1	43	2o1	1
AlD	Allegheny loam, 12 to 20 percent slopes	13	IVe-1	45	2o1	2
BeF	Berks silt loam, 40 to 70 percent slopes	13	VIIe-1	46	N-3f2, S-4f1 1/	4
Bo	Bonnie silt loam	14	IIIw-1	44	1w1	6
BrF	Brookside stony silt loam, 30 to 60 percent slopes	15	VIIs-1	46	N-2c2, S-3c2 1/	3
ChB	Chavies fine sandy loam, acid variant, 0 to 6 percent slopes	15	I-2	41	2o1	8
Ck	Clifty silt loam	16	IIs-1	43	3f1	8
CoB	Cotaco fine sandy loam, neutral variant, 2 to 6 percent slopes	16	IIw-2	43	2w1	7
CrB	Cranston gravelly silt loam, 2 to 6 percent slopes	17	IIe-3	42	2o1	1
CrC	Cranston gravelly silt loam, 6 to 12 percent slopes	17	IIIe-4	44	2o1	1
CrD	Cranston gravelly silt loam, 12 to 20 percent slopes	17	IVe-1	45	2o1	2
CrE	Cranston gravelly silt loam, 20 to 30 percent slopes	17	VIe-1	46	N-2r1, S-3r1 1/	3
CrF	Cranston gravelly silt loam, 30 to 60 percent slopes	17	VIIe-1	46	N-2r1, S-3r1 1/	3
Cu	Cuba silt loam	18	I-1	41	1o1	8
DoD	Donahue rocky sandy loam, 6 to 20 percent slopes	19	VIs-1	46	3x1	5
DoF	Donahue rocky sandy loam, 20 to 40 percent slopes	19	VIIs-1	46	3x1	5
GlC	Gilpin silt loam, 6 to 12 percent slopes	19	IIIe-5	44	3o1	1
GlD	Gilpin silt loam, 12 to 20 percent slopes	19	IVe-2	45	3o1	2
HaC	Hartsells fine sandy loam, 6 to 12 percent slopes	20	IIIe-5	44	2o1	1
HaD	Hartsells fine sandy loam, 12 to 20 percent slopes	20	IVe-2	45	2o1	2
Jo	Johnsburg silt loam	21	IIIw-2	45	2w1	7
LaC	Latham silt loam, 6 to 12 percent slopes	21	IIIe-2	43	3c1	1
LaD	Latham silt loam, 12 to 20 percent slopes	21	IVe-3	45	3c1	2
LaE	Latham silt loam, 20 to 30 percent slopes	21	VIe-2	46	N-2c2, S-3c2 1/	3
LsD	Latham-Shelocta silt loams, 12 to 20 percent slopes	22	IVe-3	45	3c1	2
LsE	Latham-Shelocta silt loams, 20 to 30 percent slopes	22	VIe-2	46	N-2c2, S-3c2 1/	3
LsF	Latham-Shelocta silt loams, 30 to 50 percent slopes	22	VIIe-1	46	N-2c2, S-3c2 1/	3
MoB	Monongahela fine sandy loam, 2 to 6 percent slopes	23	IIe-2	42	3o1	1
Mp	Morehead silt loam	23	IIw-2	43	2w1	7
Mr	Mullins silt loam	24	IVw-1	45	1w1	6
MsB	Muse silt loam, 2 to 6 percent slopes	25	IIe-1	41	3c1	1

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Woodland suitability group Symbol	Wildlife group Number
MsC	Muse silt loam, 6 to 12 percent slopes	25	IIIe-1	43	3c1	1
MsD	Muse silt loam, 12 to 20 percent slopes	25	IVe-1	45	3c1	2
MsE	Muse silt loam, 20 to 30 percent slopes	25	VIe-2	46	N-2c2, S-3c2 1/	3
MtF	Muse-Trappist stony silt loams, 30 to 60 percent slopes	25	VIIs-1	46	N-2c2, S-3c2 1/	3
Po	Pope fine sandy loam	25	I-1	41	1o1	8
Pp	Pope gravelly fine sandy loam	26	I-1	41	1o1	8
ReB	Renox gravelly fine sandy loam, 2 to 6 percent slopes	27	IIe-3	43	2o1	1
ReC	Renox gravelly fine sandy loam, 6 to 15 percent slopes	27	IIIe-4	44	2o1	1
RgB	Rigley gravelly fine sandy loam, 2 to 6 percent slopes	27	IIe-3	42	2o1	1
RgC	Rigley gravelly fine sandy loam, 6 to 12 percent slopes	27	IIIe-4	44	2o1	1
RgD	Rigley gravelly fine sandy loam, 12 to 20 percent slopes	28	IVe-1	45	2o1	2
RgE	Rigley gravelly fine sandy loam, 20 to 30 percent slopes	28	VIe-1	46	N-2r1, S-3r1 1/	3
RlF	Rigley stony fine sandy loam, 30 to 60 percent slopes	28	VIIs-1	46	N-2r1, S-3r1 1/	3
RoD	Rigley-Donahue complex, 6 to 20 percent slopes	28	IVe-1	45	2o1	2
RoE	Rigley-Donahue complex, 20 to 30 percent slopes	28	VIIs-1	46	N-2r1, S-3r1 1/	3
RoF	Rigley-Donahue complex, 30 to 60 percent slopes	28	VIIs-1	46	N-2r1, S-3r1 1/	3
Sd	Skidmore gravelly fine sandy loam	29	IIs-1	43	3f1	8
SrD	Steinsburg-Ramsey rocky sandy loams, 6 to 20 percent slopes	30	VIs-1	46	4x1	4
SrF	Steinsburg-Ramsey rocky sandy loams, 20 to 40 percent slopes	30	VIIs-1	46	4x1	4
St	Stendal silt loam	31	IIw-1	43	1w1	7
Sv	Stendal fine sandy loam, neutral variant	32	IIw-1	43	1w1	7
Sx	Strip mines	32	------	--	--------------	----
TlB	Tilsit silt loam, 2 to 6 percent slopes	33	IIe-2	42	3o1	1
TlC	Tilsit silt loam, 6 to 12 percent slopes	33	IIIe-3	44	3o1	1
WhC	Whitley silt loam, 6 to 12 percent slopes	34	IIIe-1	43	2o1	1
WhD	Whitley silt loam, 12 to 20 percent slopes	34	IVe-1	45	2o1	2
WtA	Whitley silt loam, terrace, 0 to 2 percent slopes	34	I-2	41	2o1	8
WtB	Whitley silt loam, terrace, 2 to 6 percent slopes	34	IIe-1	41	2o1	1
WtC	Whitley silt loam, terrace, 6 to 12 percent slopes	34	IIIe-1	43	2o1	1

1/ The letter "N" denotes north and east aspects, and the letter "S" denotes south and west aspects.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 1

1



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

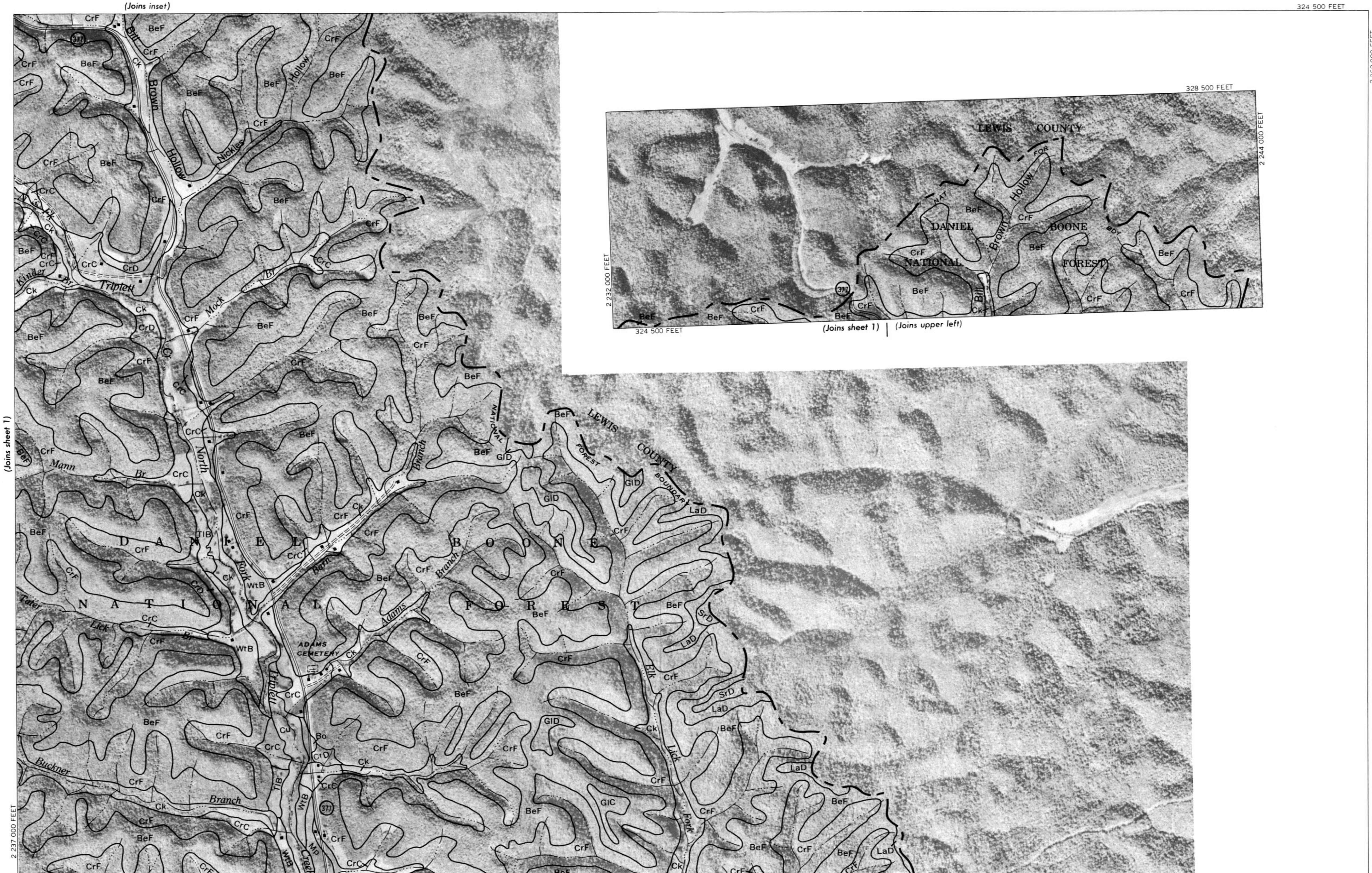
2

N

Scale 1:20000

1 Mile | 5000 Feet

(Joins sheet 1)



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

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MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 2

3

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 3

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

N

Scale 1:20000

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

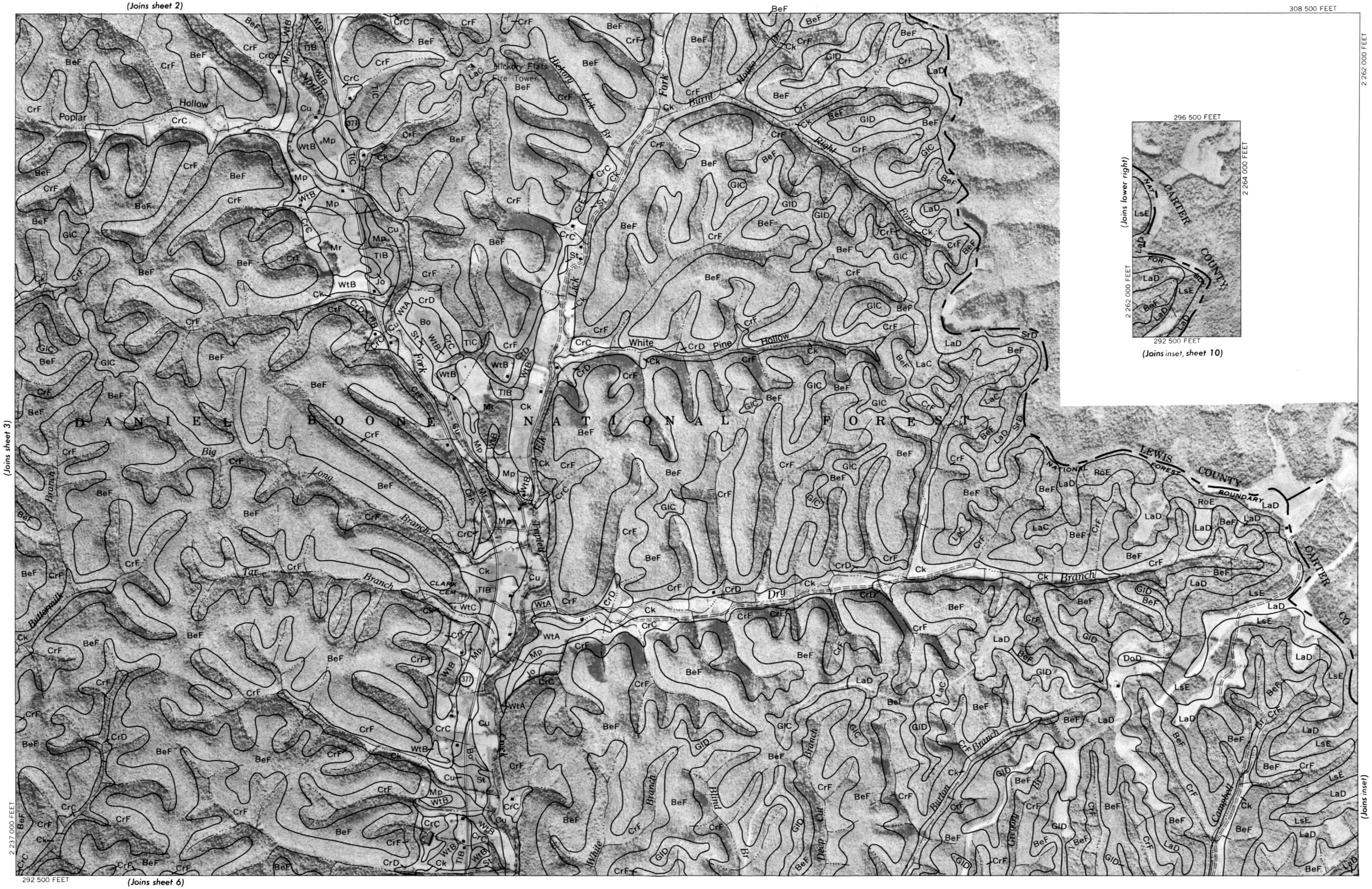
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 4

N

Scale 1:20000

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0 5000



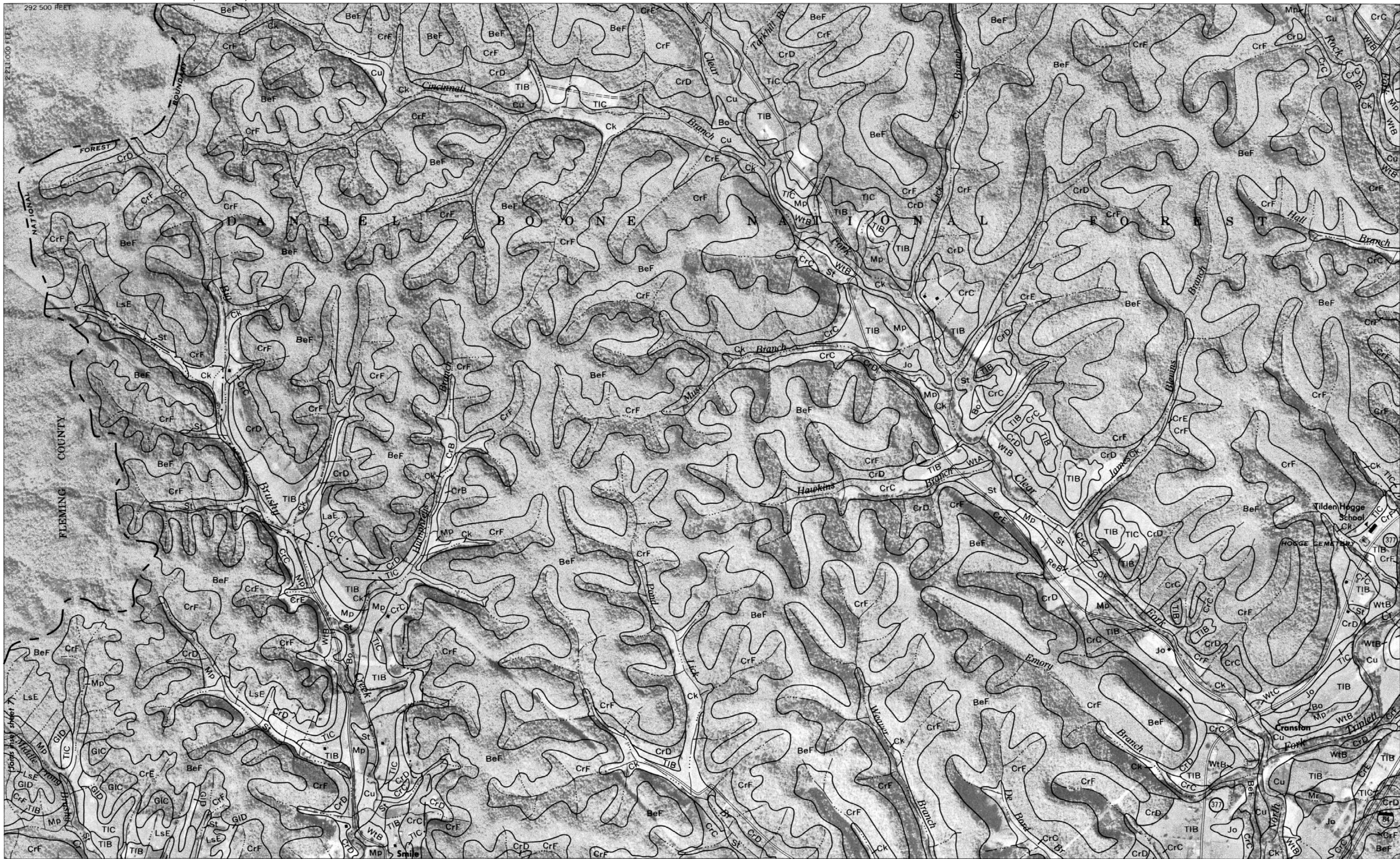
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 4

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

(Joins sheet 3)

N



(Joins sheet 6)

1 Mile

5000 Feet

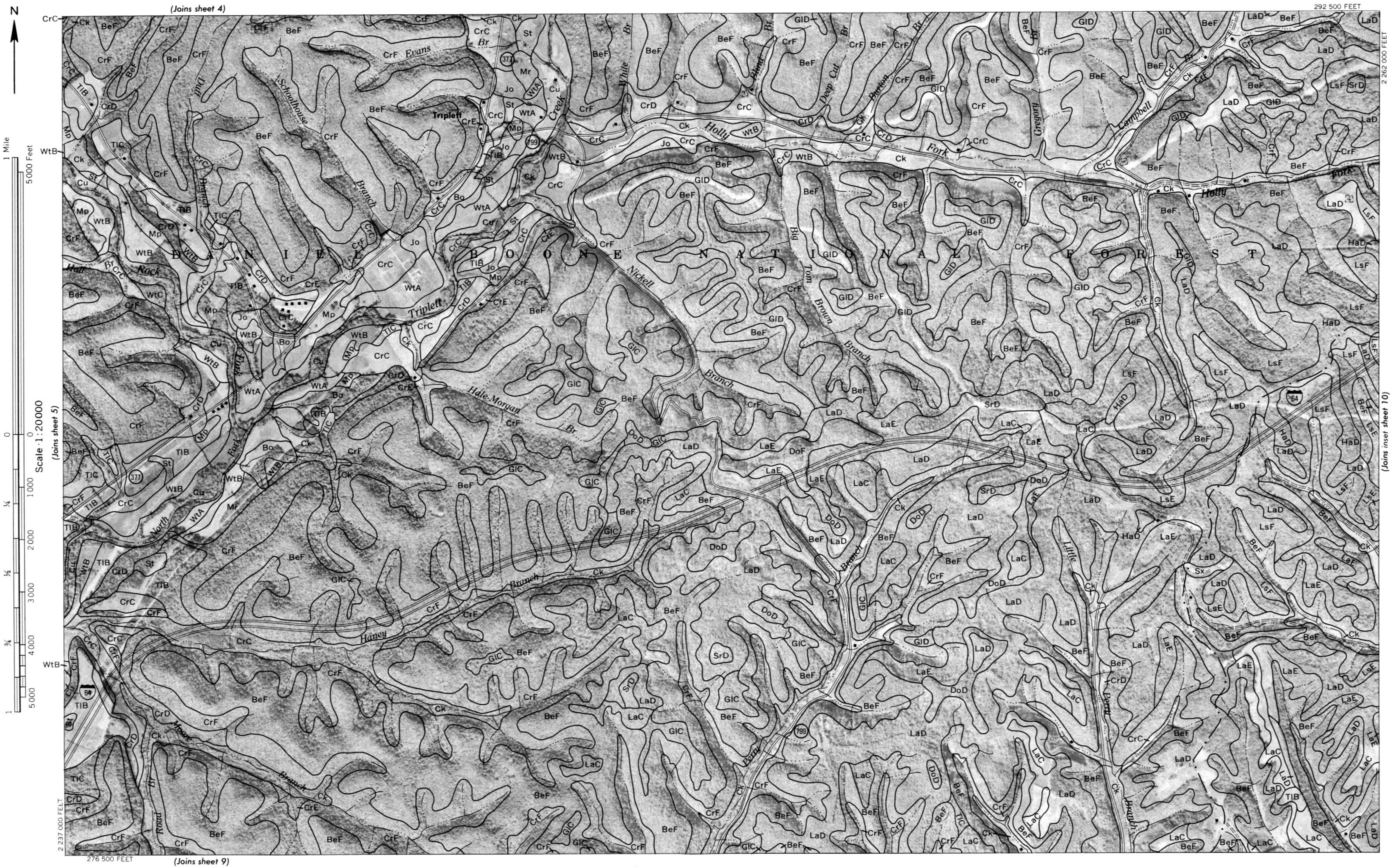
0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Scale 1:20000

(7) | (Joins sheet 8)

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

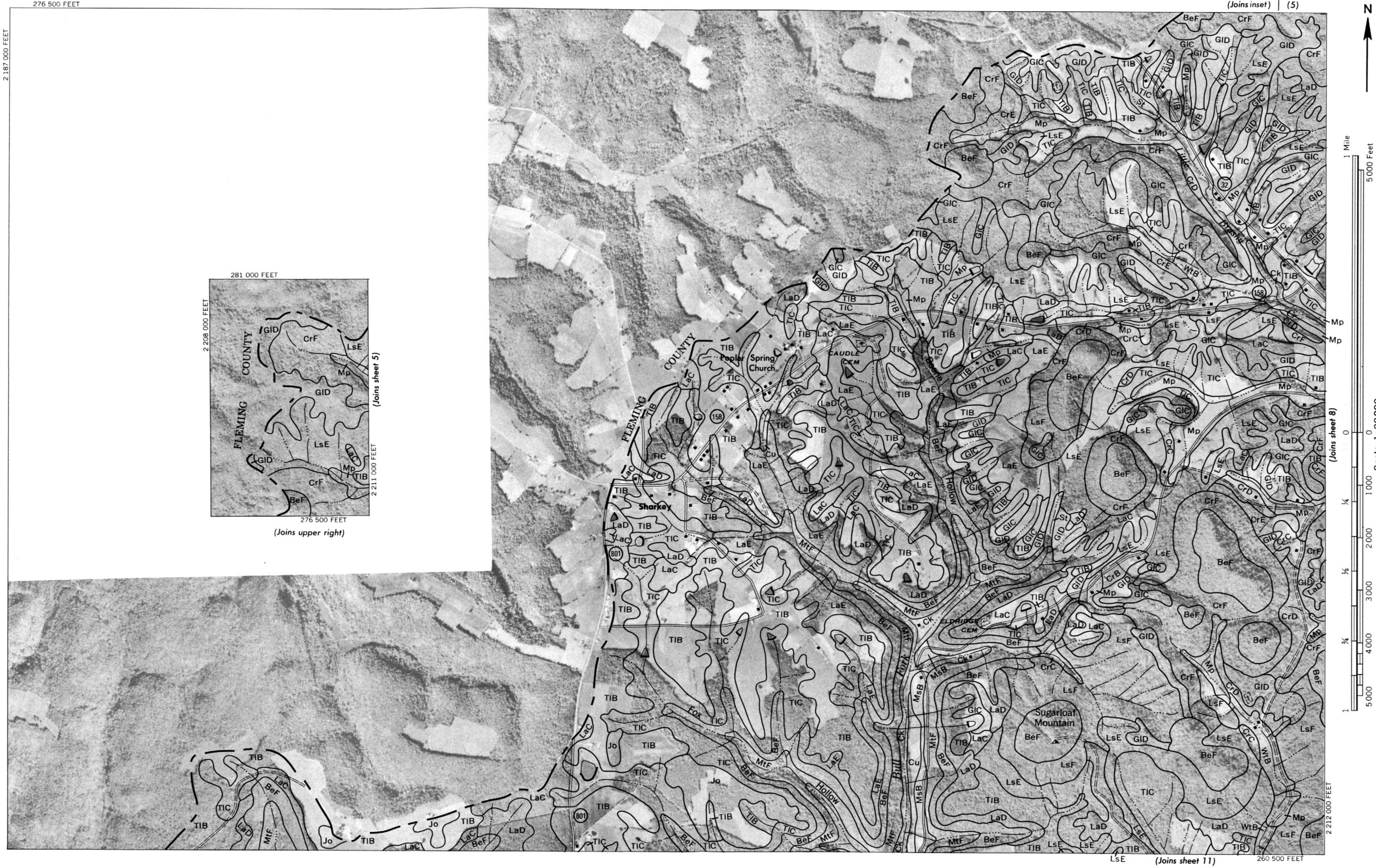


This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 6

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

N

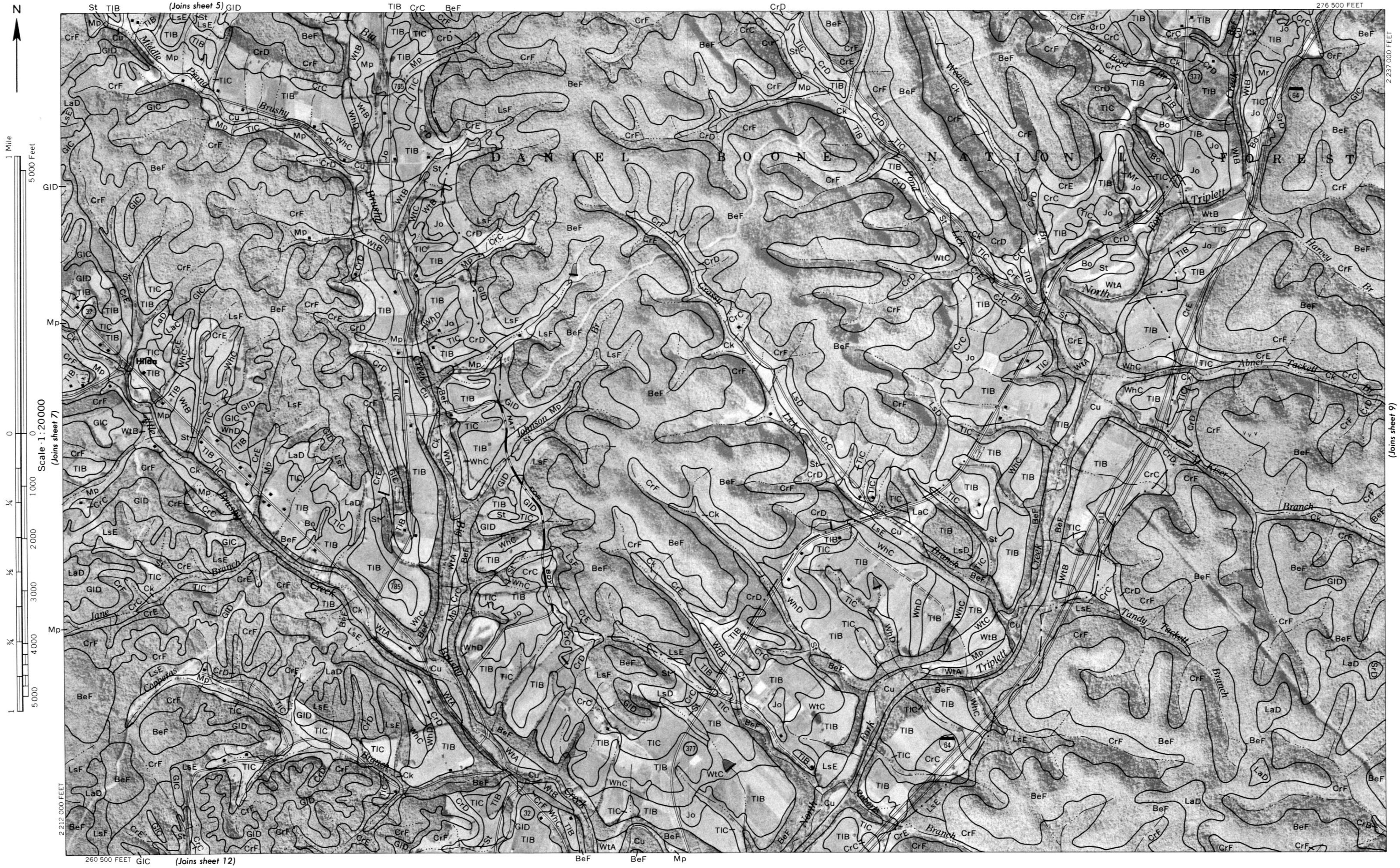


MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 7

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

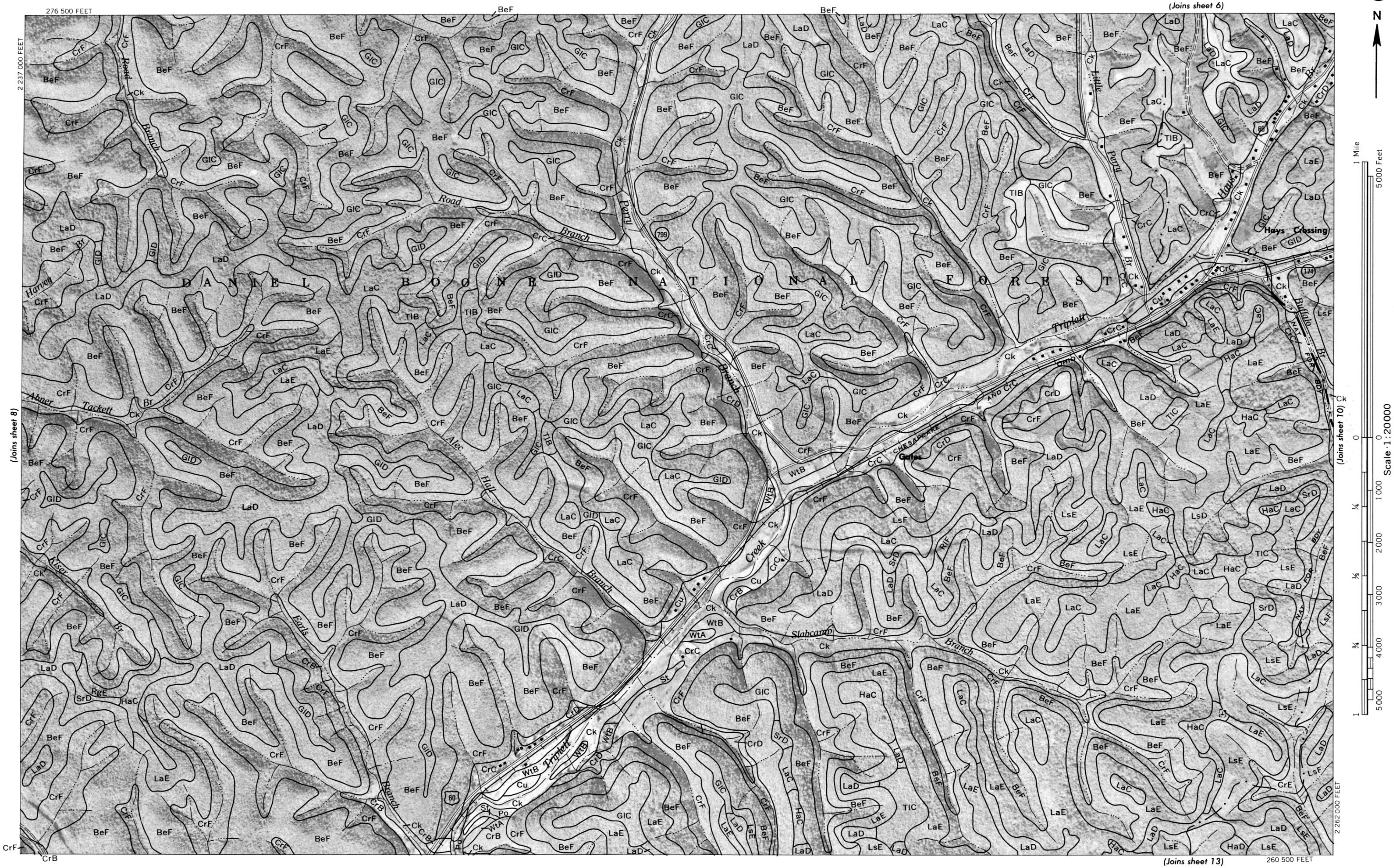
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 8



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 8

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 9

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 10

N

Scale 1:20000

1 Mile

5000 Feet

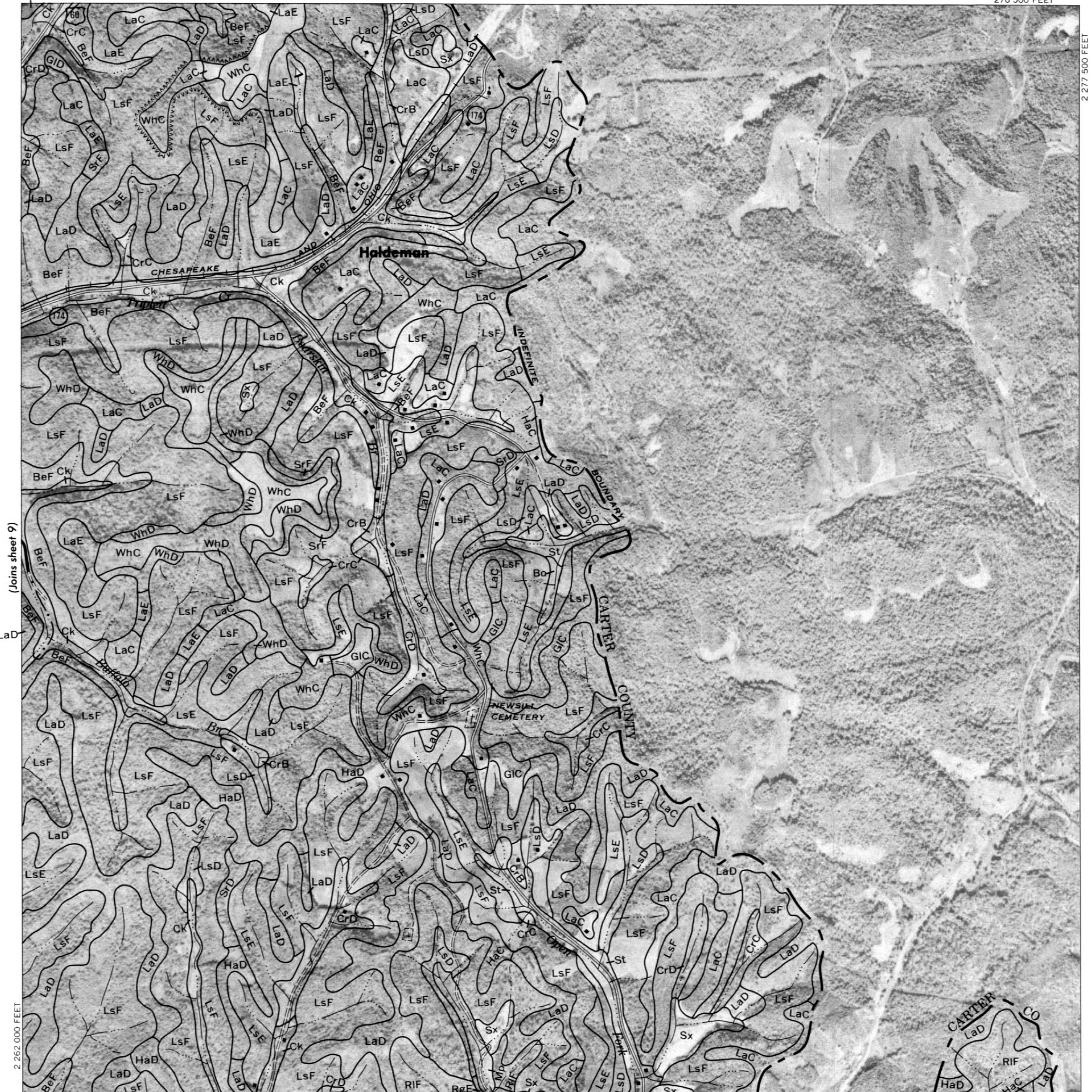
0 1000 2000 3000 4000 5000

(Joins inset)

276 500 FEET

2 277 500 FEET

(Joins sheet 9)



2 262 000 FEET

260 500 FEET

(Joins sheet 14)

(Joins inset, sheet 4)

292 500 FEET

2 270 000 FEET

(Joins sheet 6)

2 262 000 FEET

276 500 FEET

(Joins upper left)

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 10

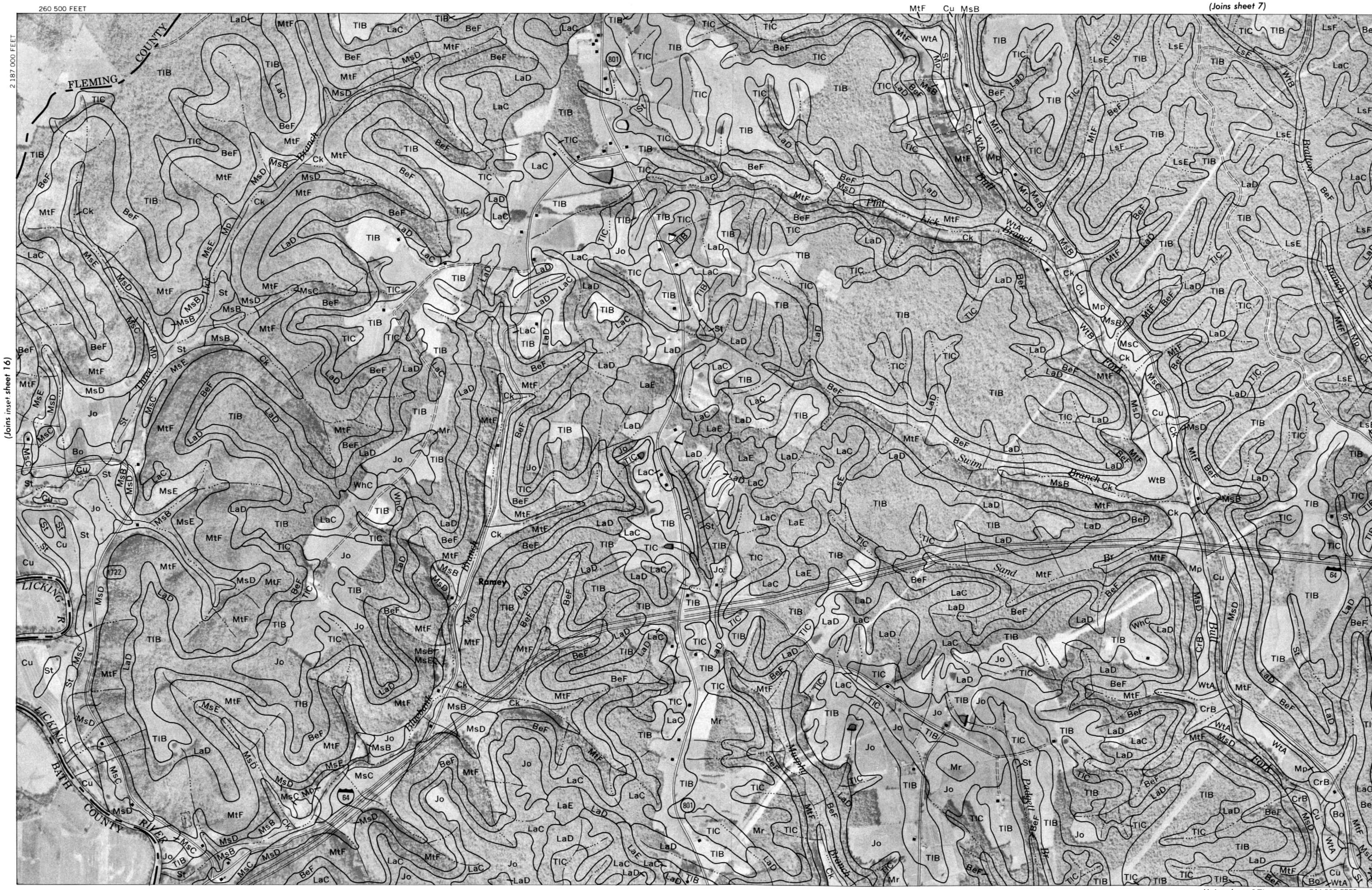
11

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 11

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

260 500 FEET

2 187 000 FEET



N

Scale 1:20000

1 Mile

5000 Feet

2 212 000 FEET

244 500 FEET

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

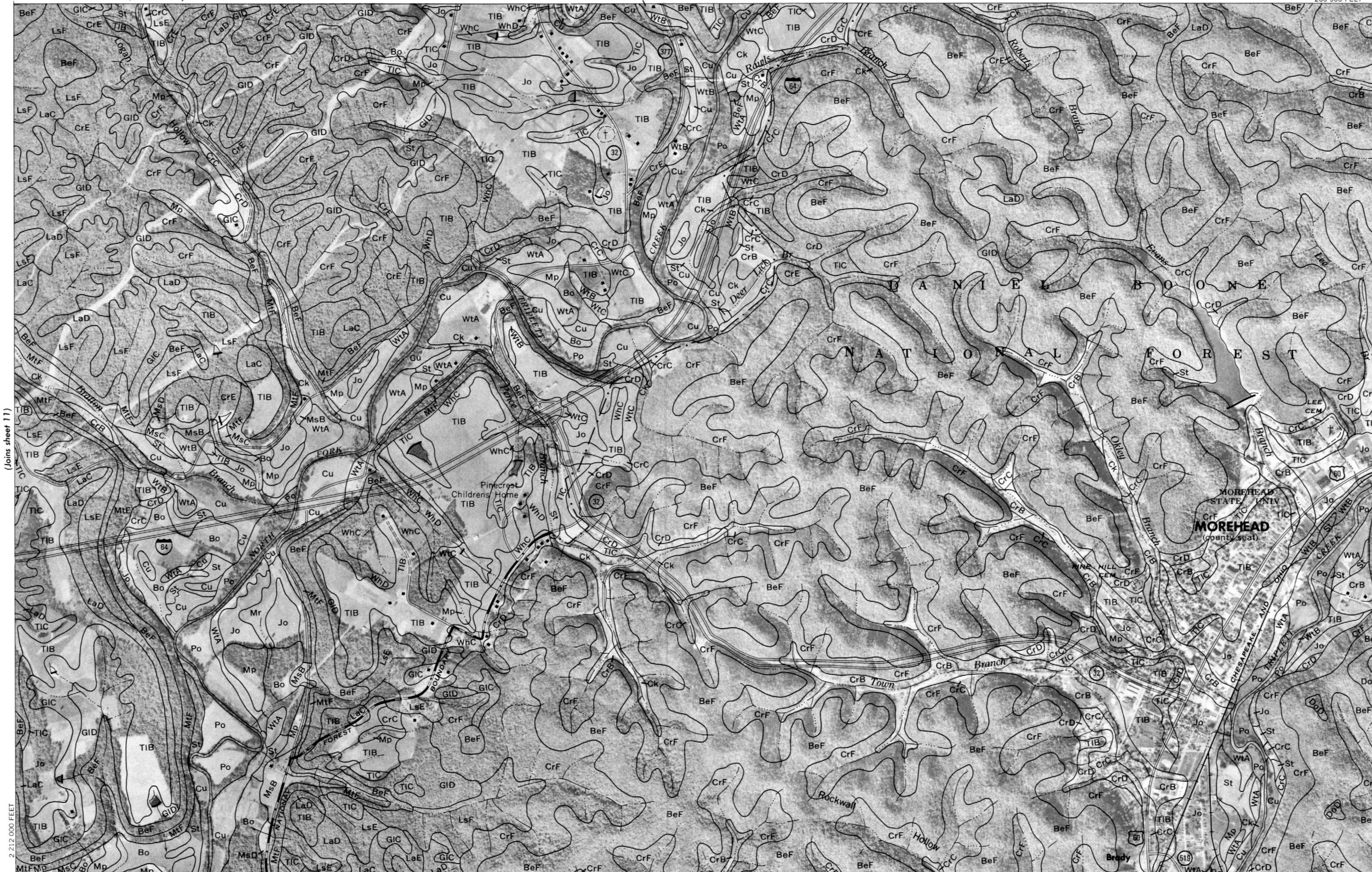
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 12

N

(Joins sheet 8)

260 500 FEET

2 237 000 FEET



1 Mile

5000 Feet

Scale 1:20000

0 — 1000 — 2000 — 3000 — 4000 — 5000

0 — ¼ — ½ — ¾ — 1

(Joins sheet 11)

(Joins sheet 13)

2 212 000 FEET

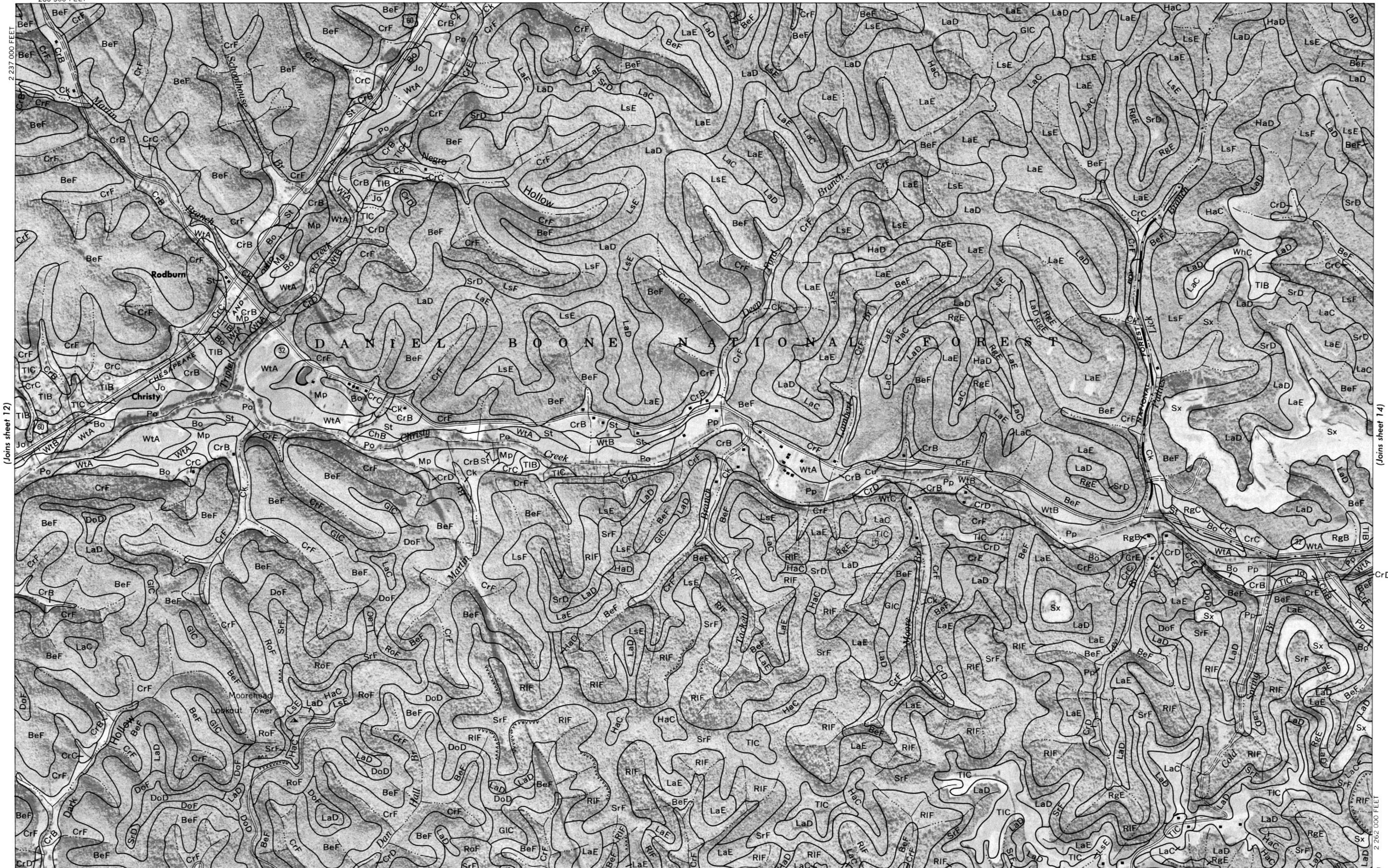
244 500 FEET

(Joins sheet 18)

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 12

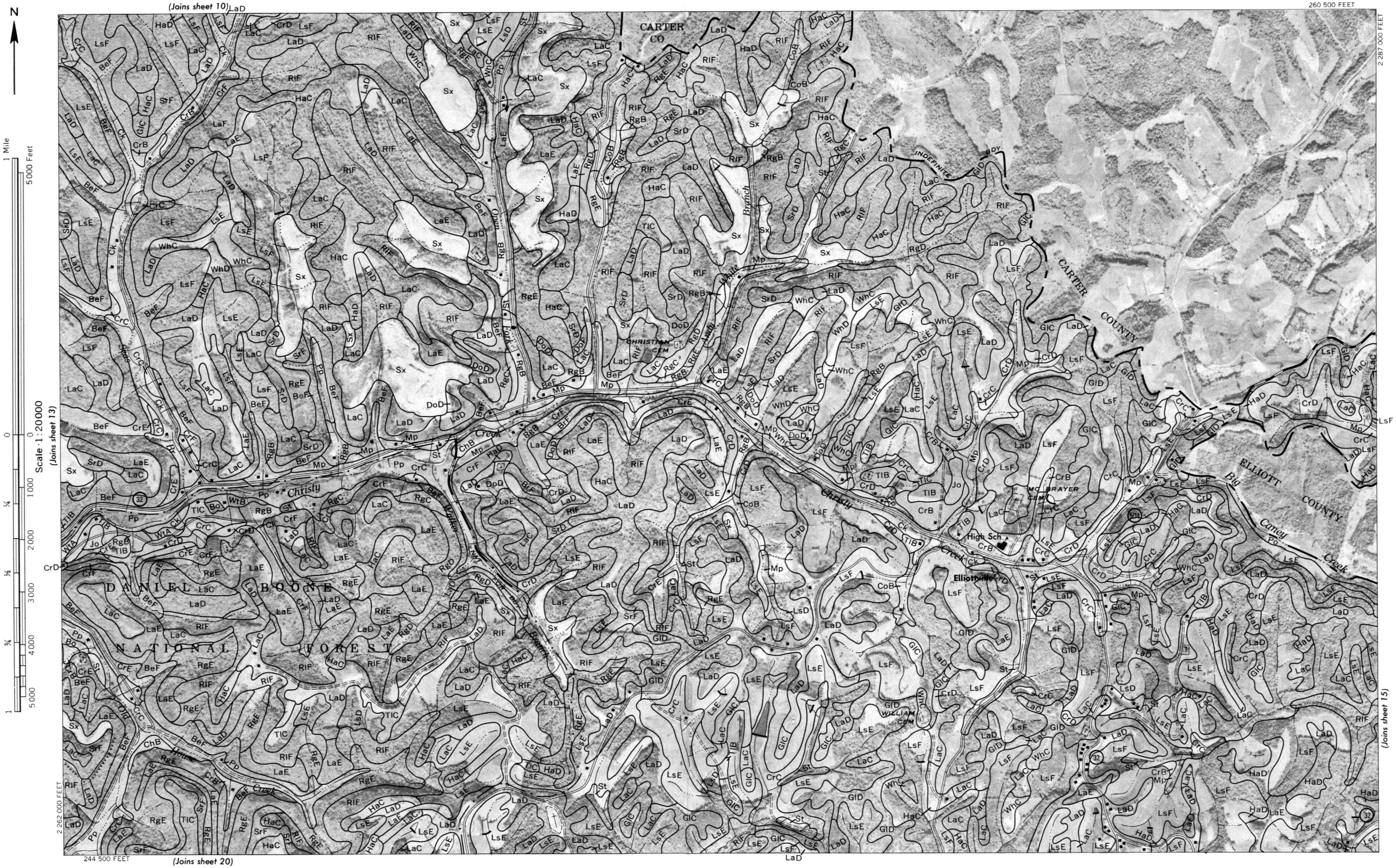
Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 13

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

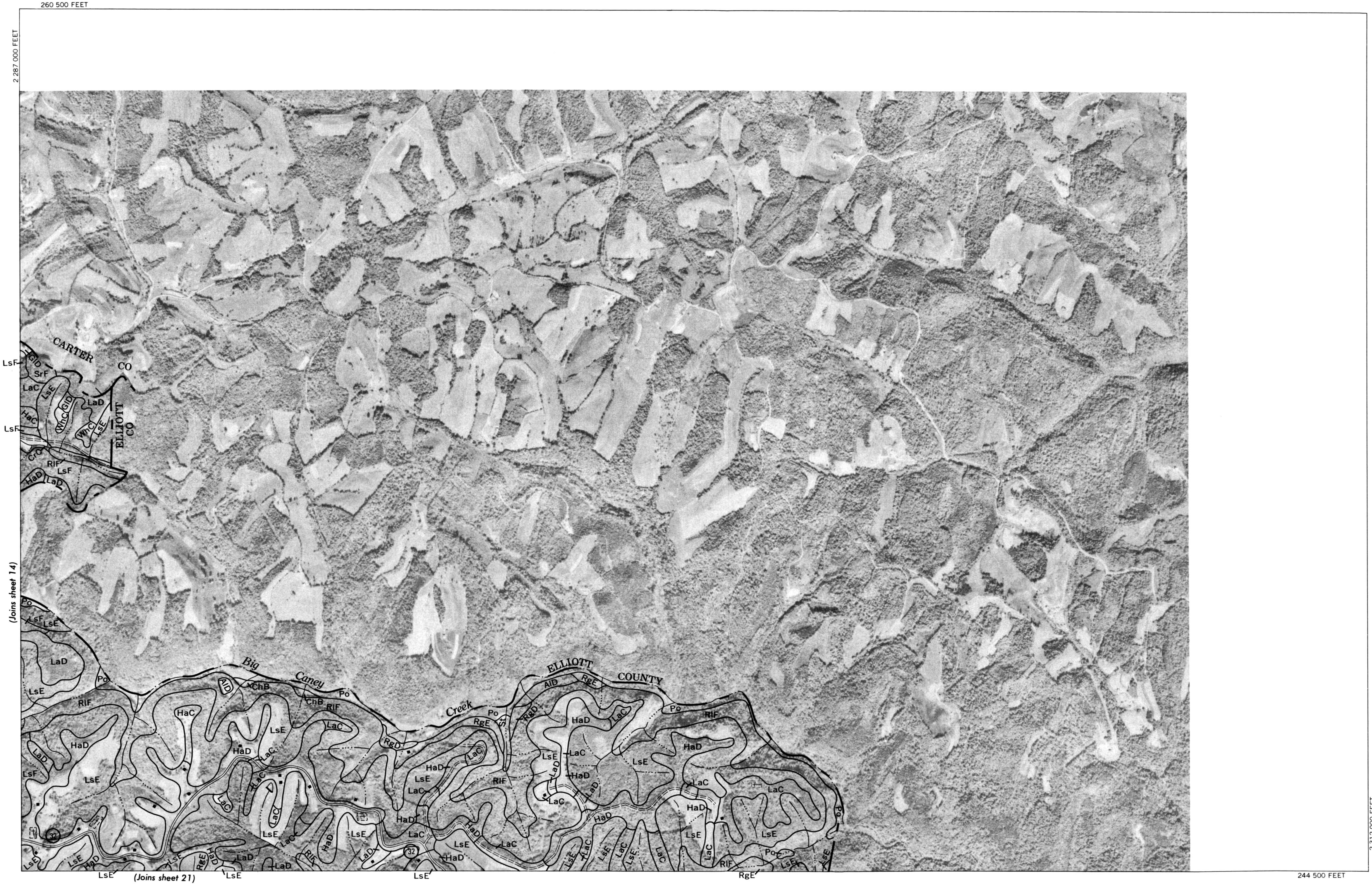


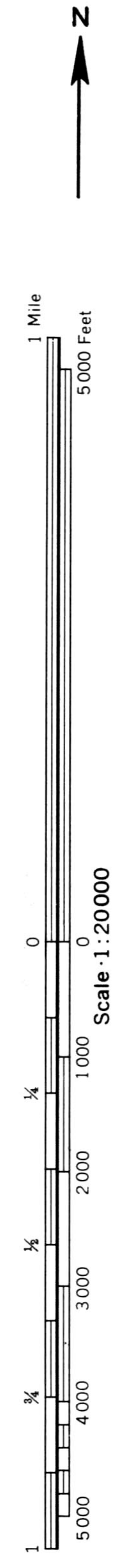
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

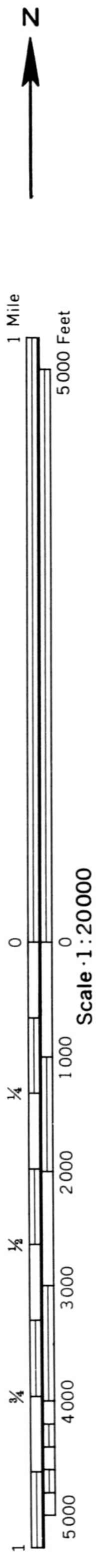
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 15

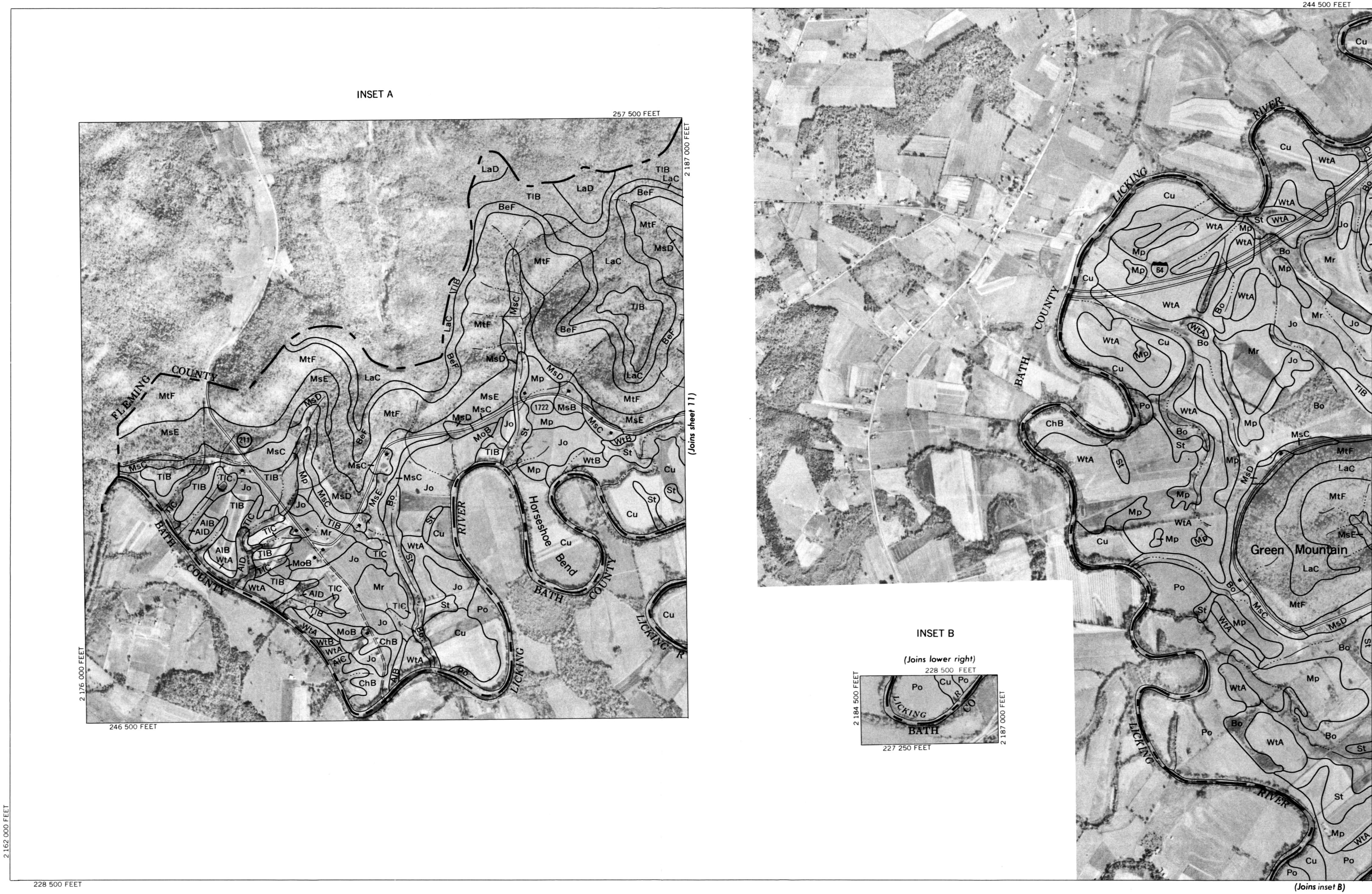
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.





Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.





Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

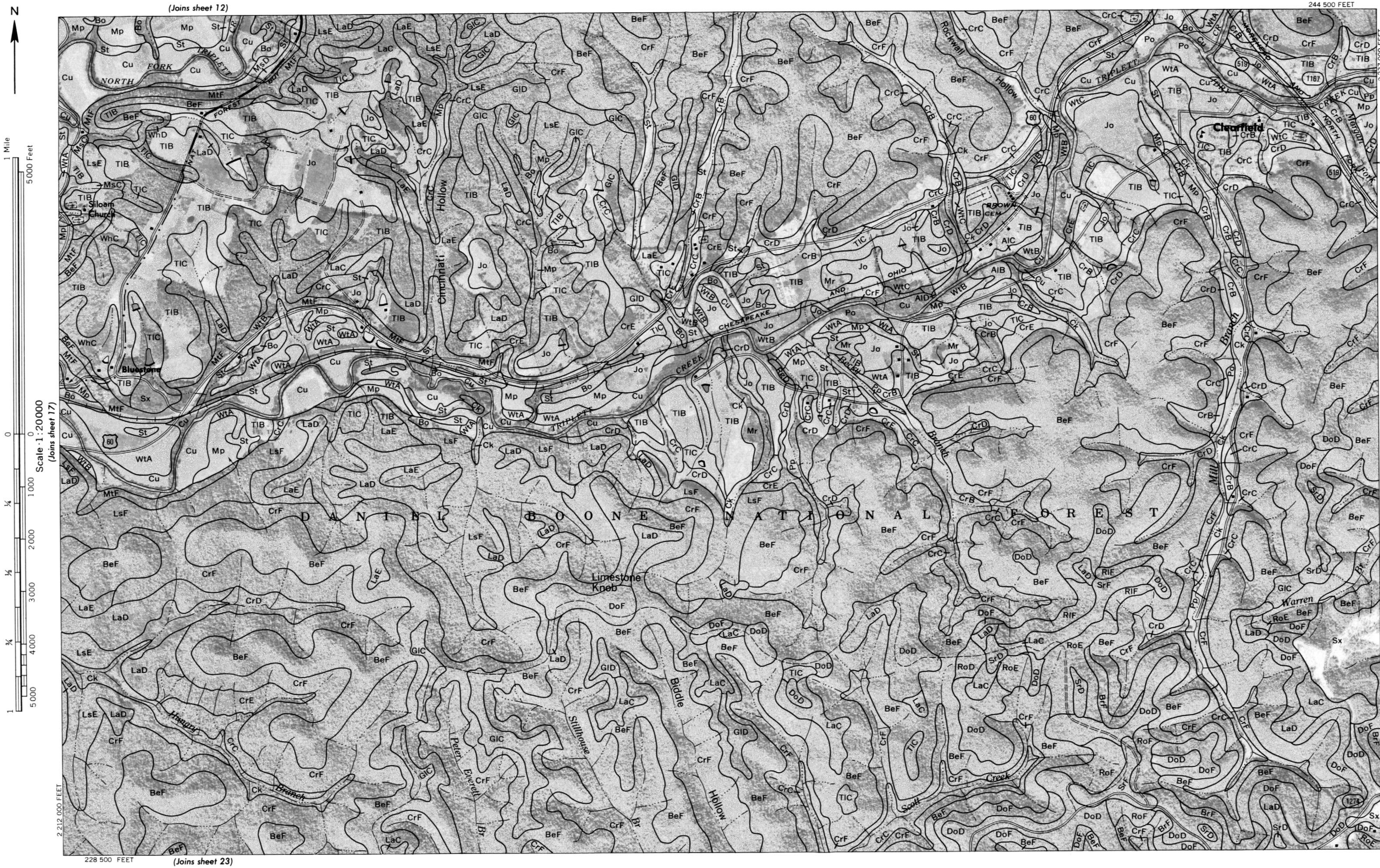
17

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 17

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone

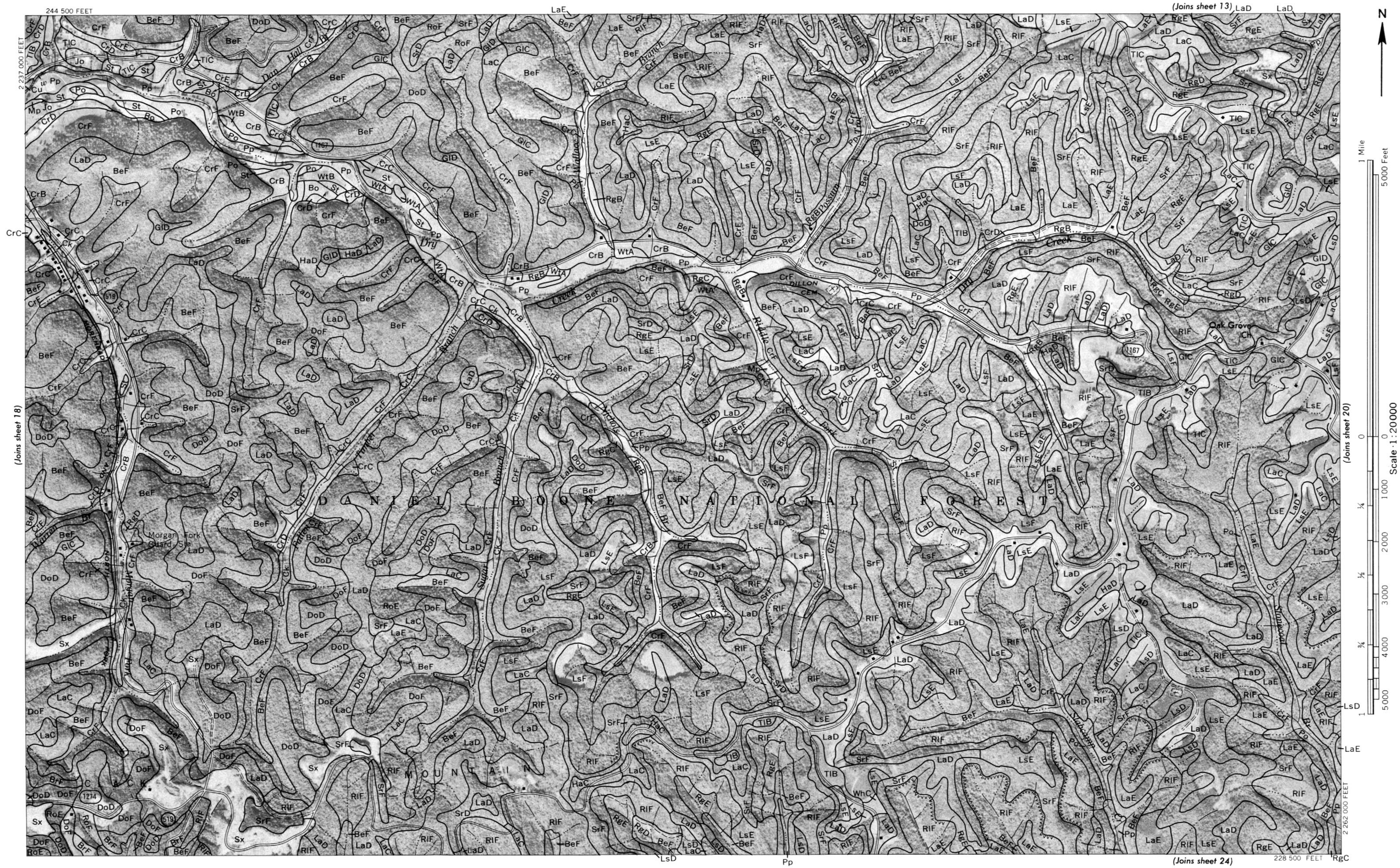
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 18



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 18

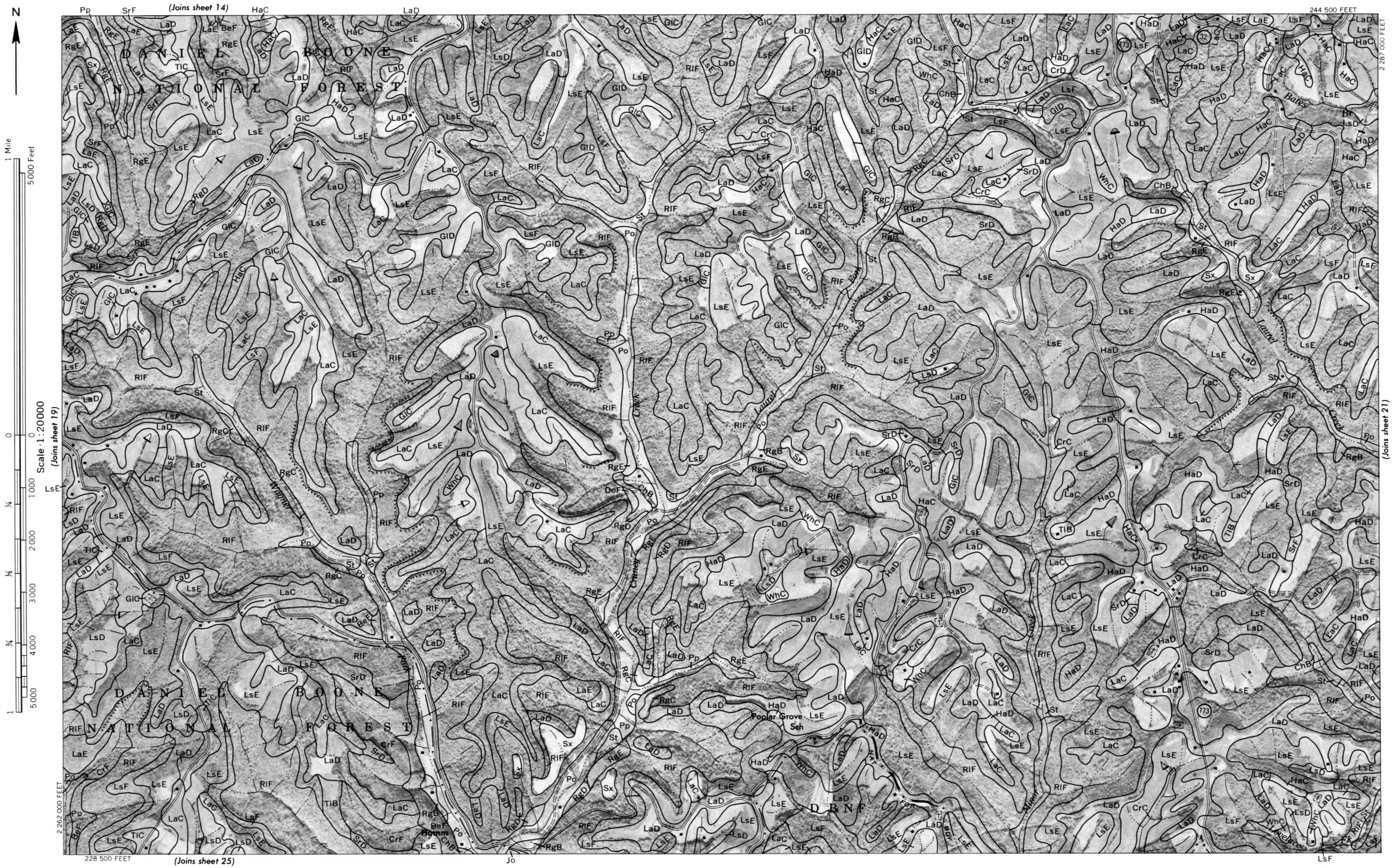
Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 20



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 20

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

(21)

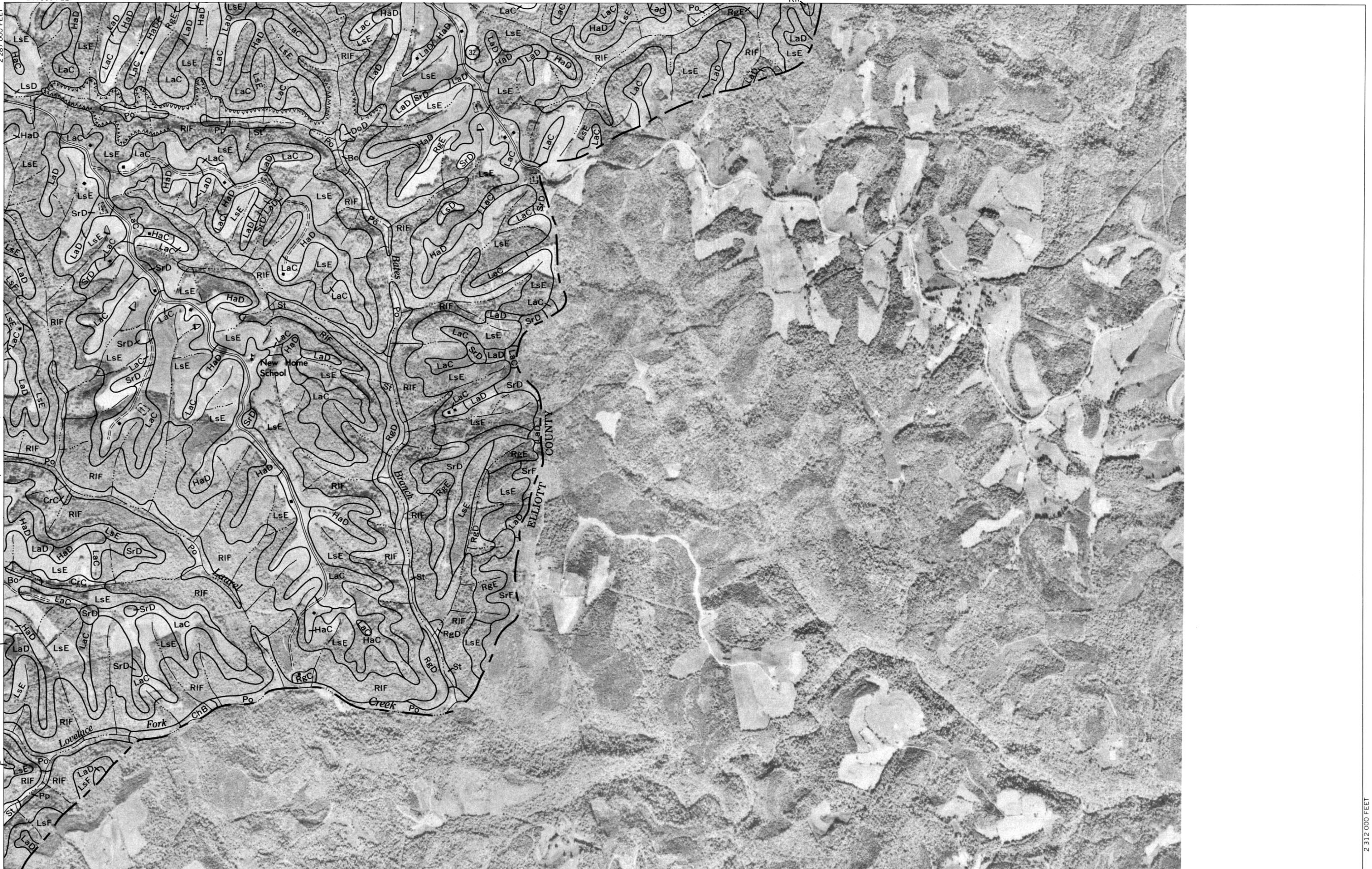
N

244 500 FEET

(Joins sheet 15)

2 287 000 FEET

(Joins sheet 20)



(25)

228 500 FEET

2 312 000 FEET

1 Mile

5000 Feet

Scale 1:20000

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 21

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

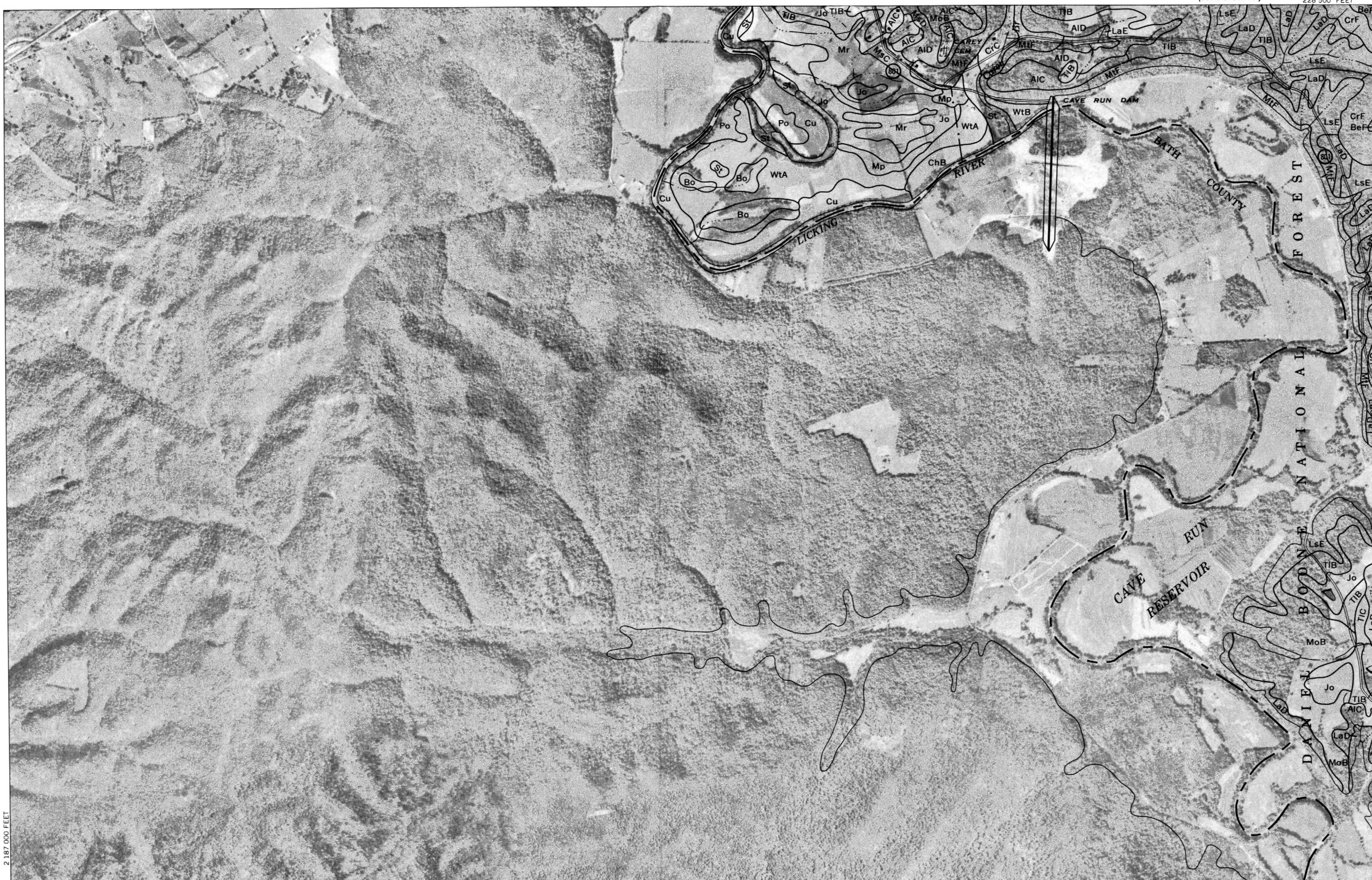
N

1 Mile
5 000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

23

N

1 Mile
5000 Feet
0
0
1000
1/4
2000
1/2
3000
4000
3/4
5000
1
Scale 1:20000

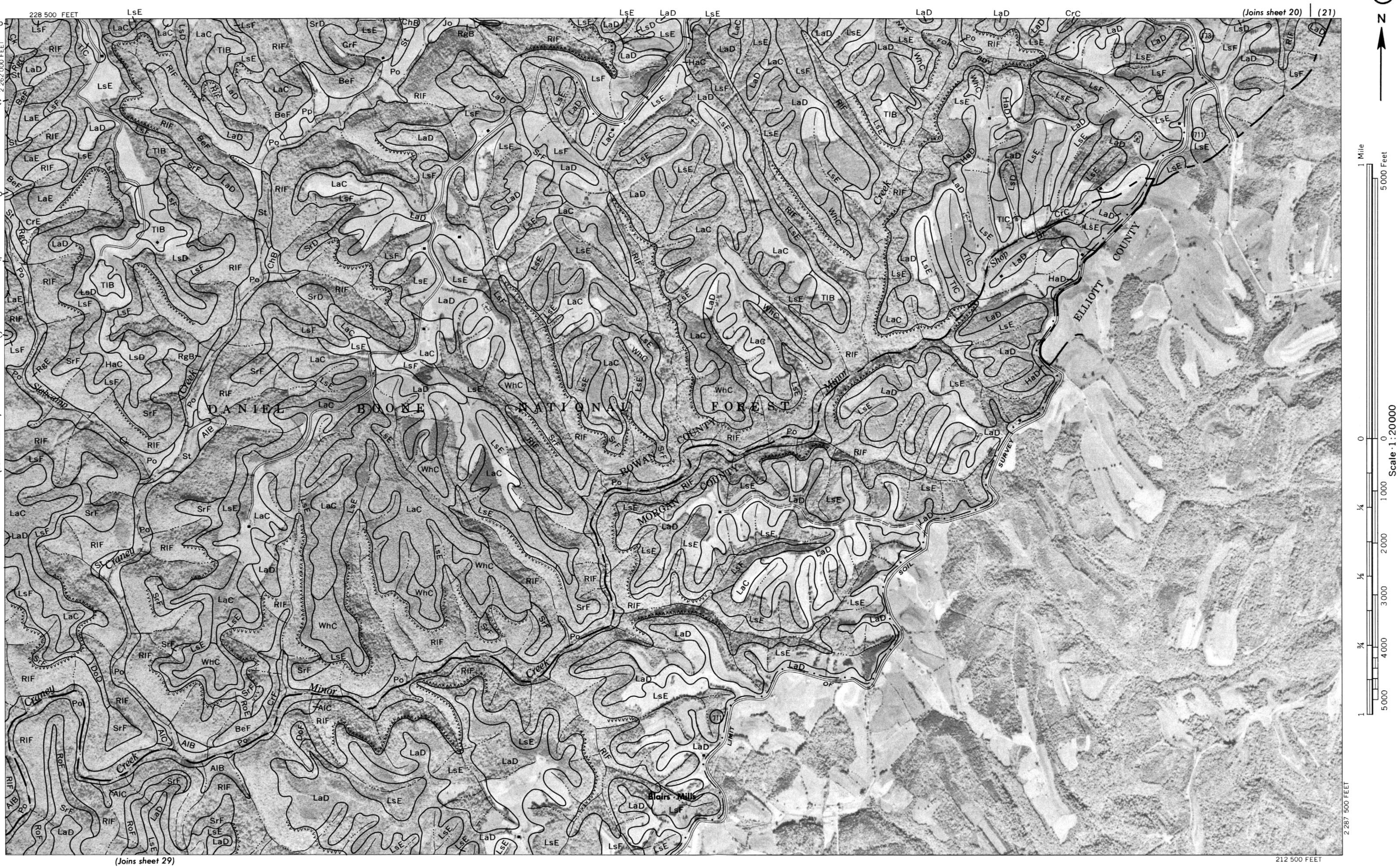
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 23

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 25

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

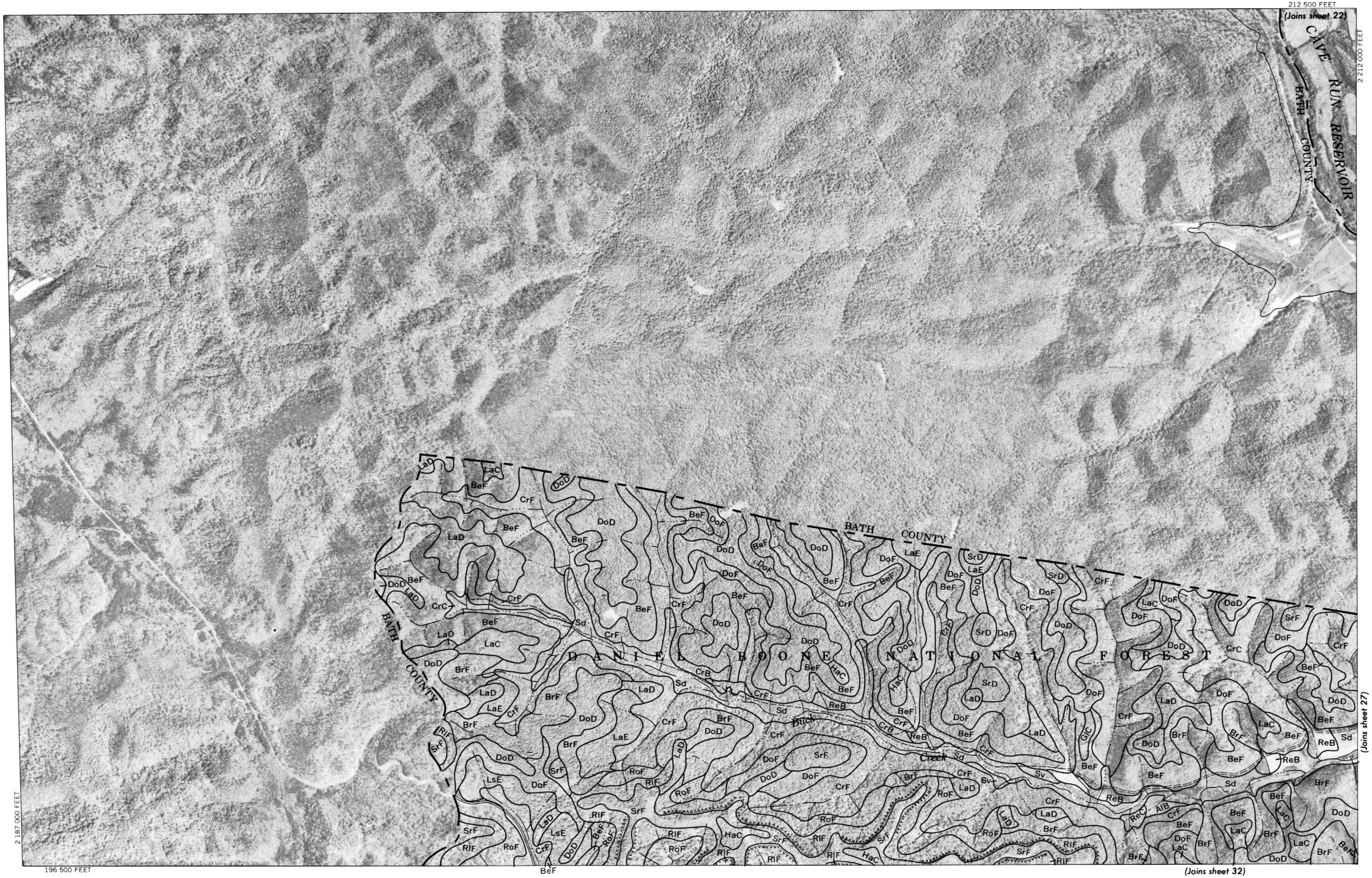
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 26

N

Scale 1:20000

1 Mile ¾ ½ ¼ 0

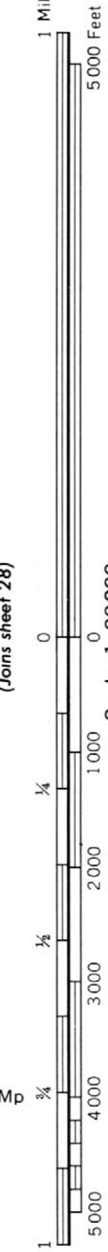
5000 Feet 4000 3000 2000 1000 0



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

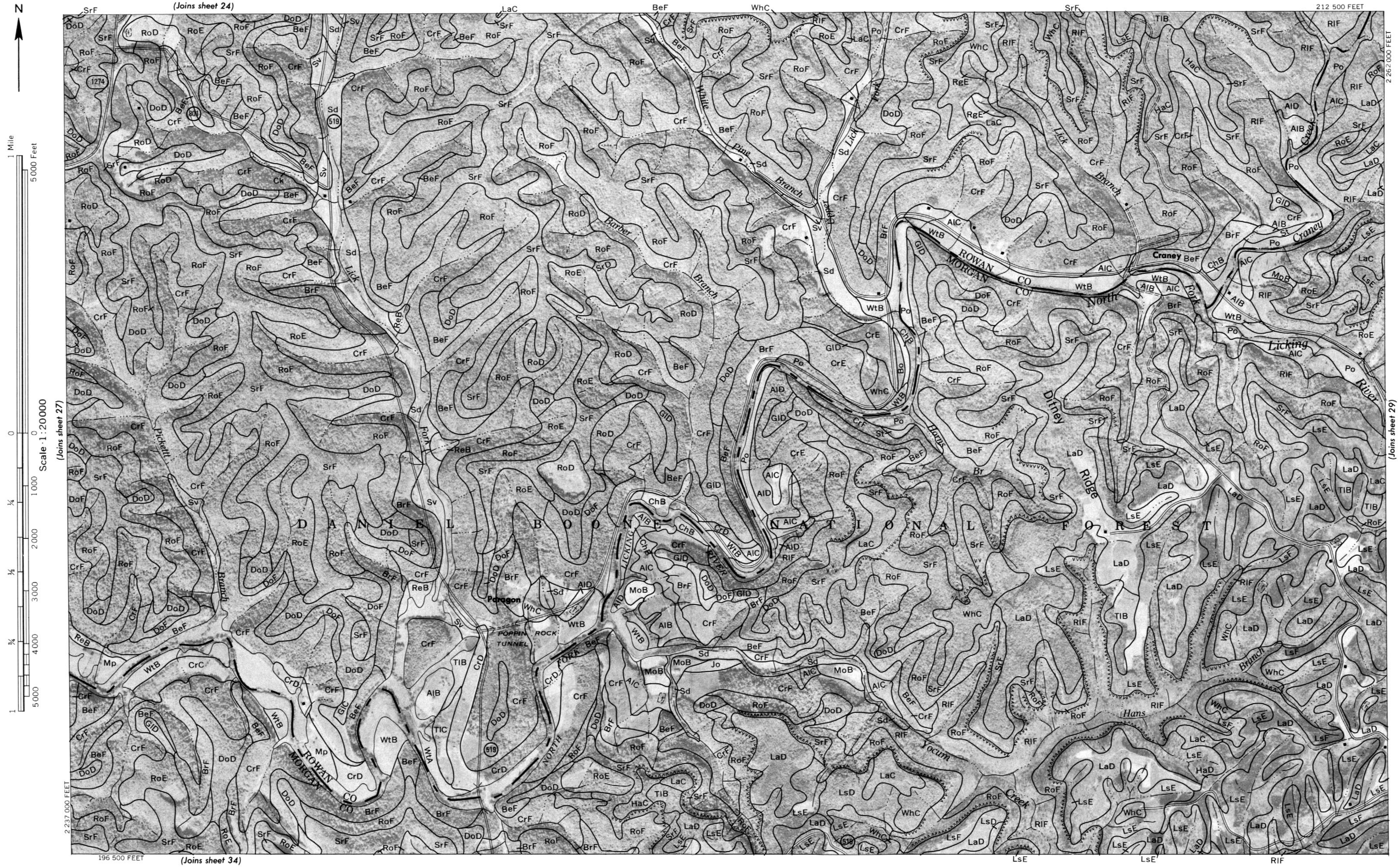
N



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 27

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



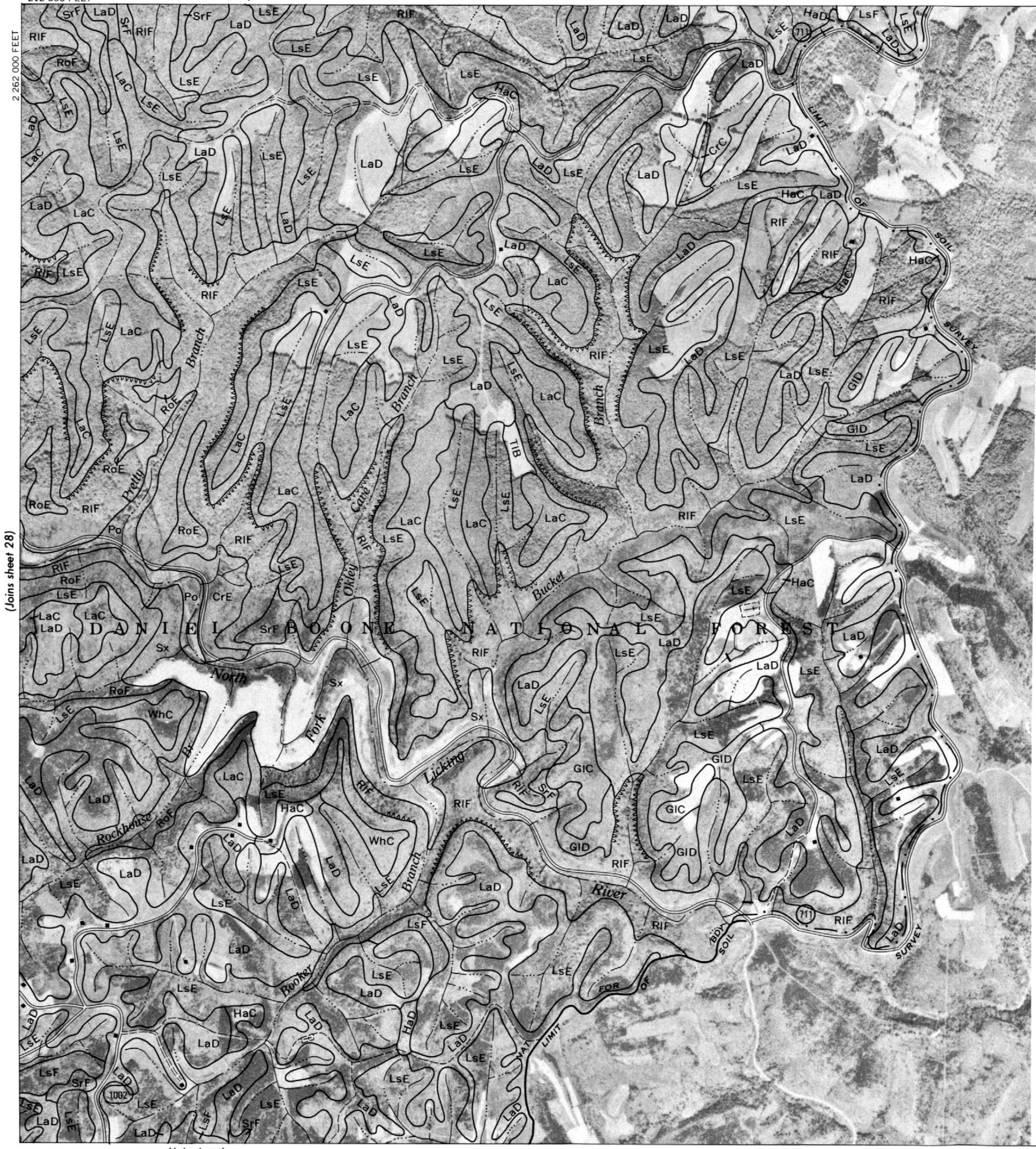
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

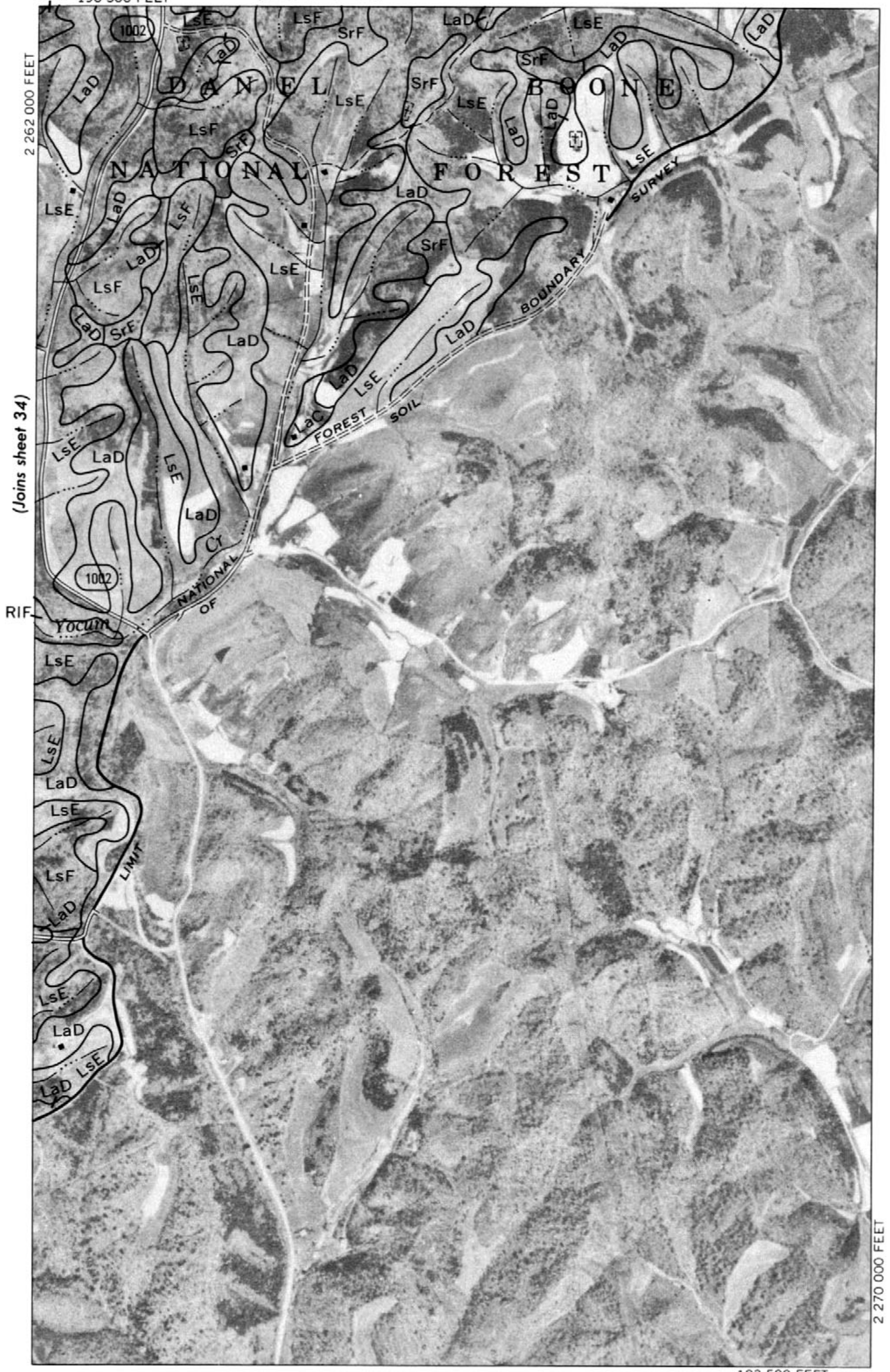
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 28

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 29

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.





2 287 000 FEET

196 500 FEET

N

1 Mile

5000 Feet

Scale 1:20000

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

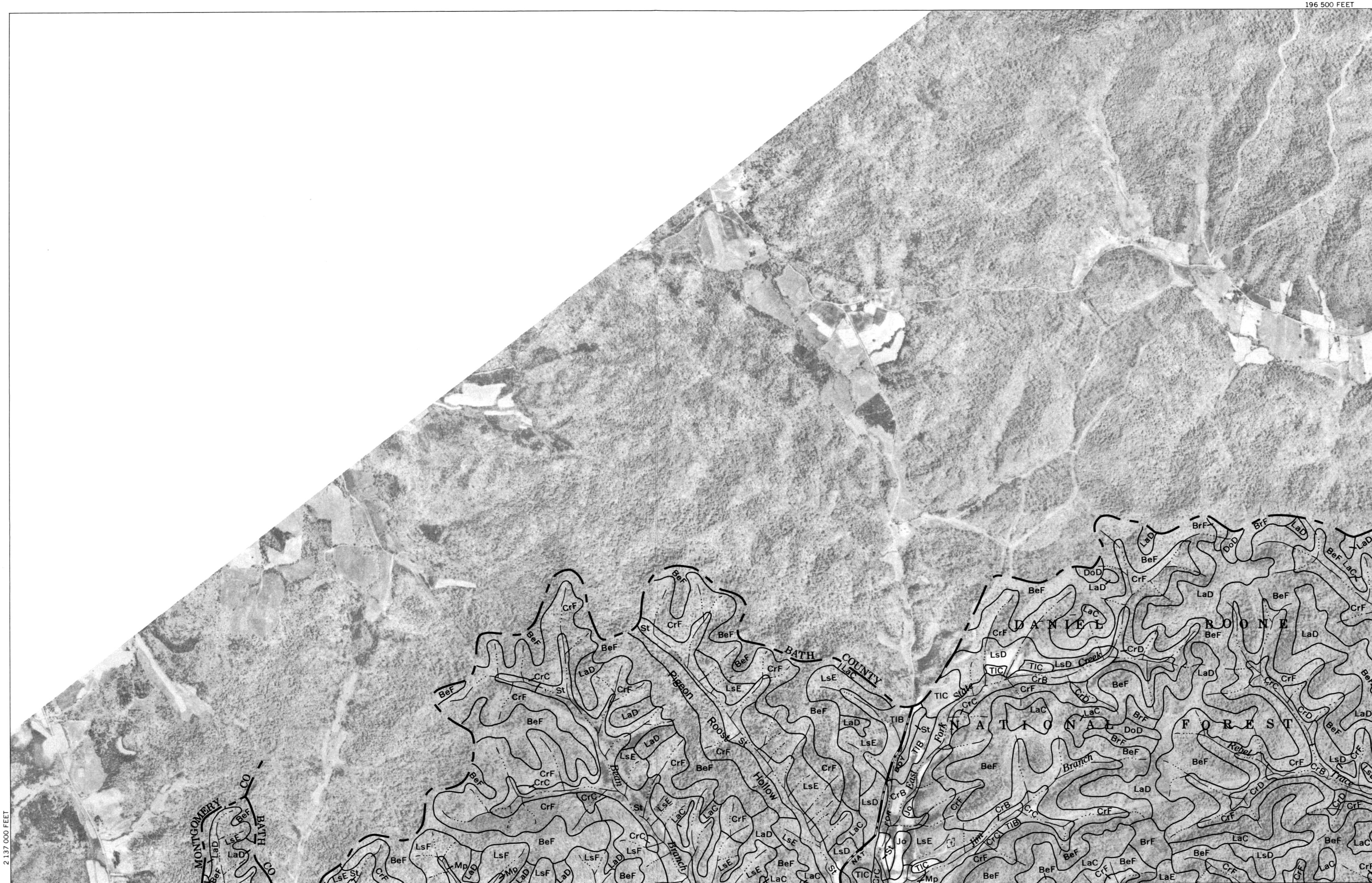
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 30

N

Scale 1:20000

1 Mile — ¾ — ½ — ¼ — 0

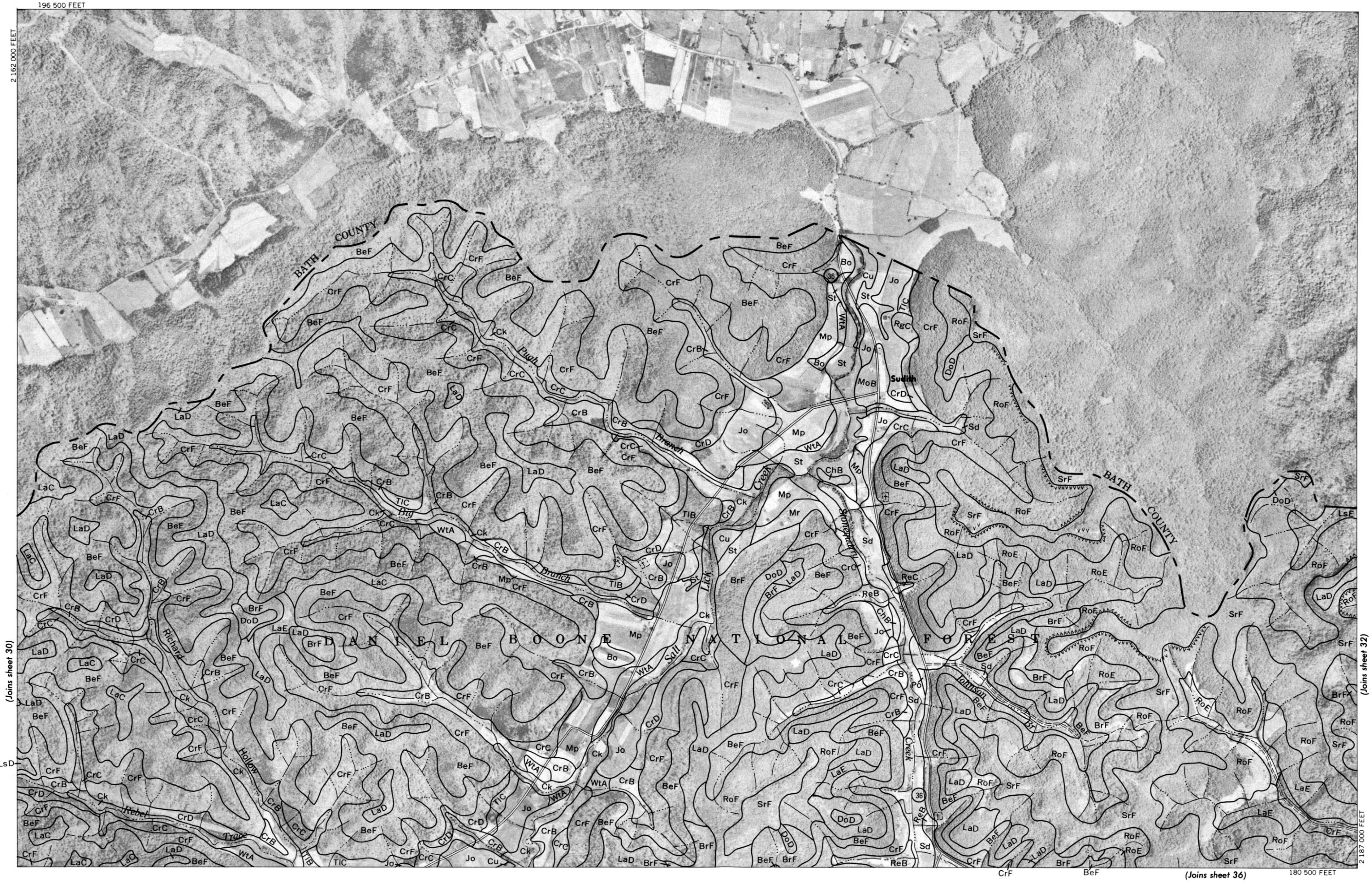
5000 Feet — 4000 — 3000 — 2000 — 1000 — 0



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

31



N

Scale 1:20000

1 Mile

5000 Feet

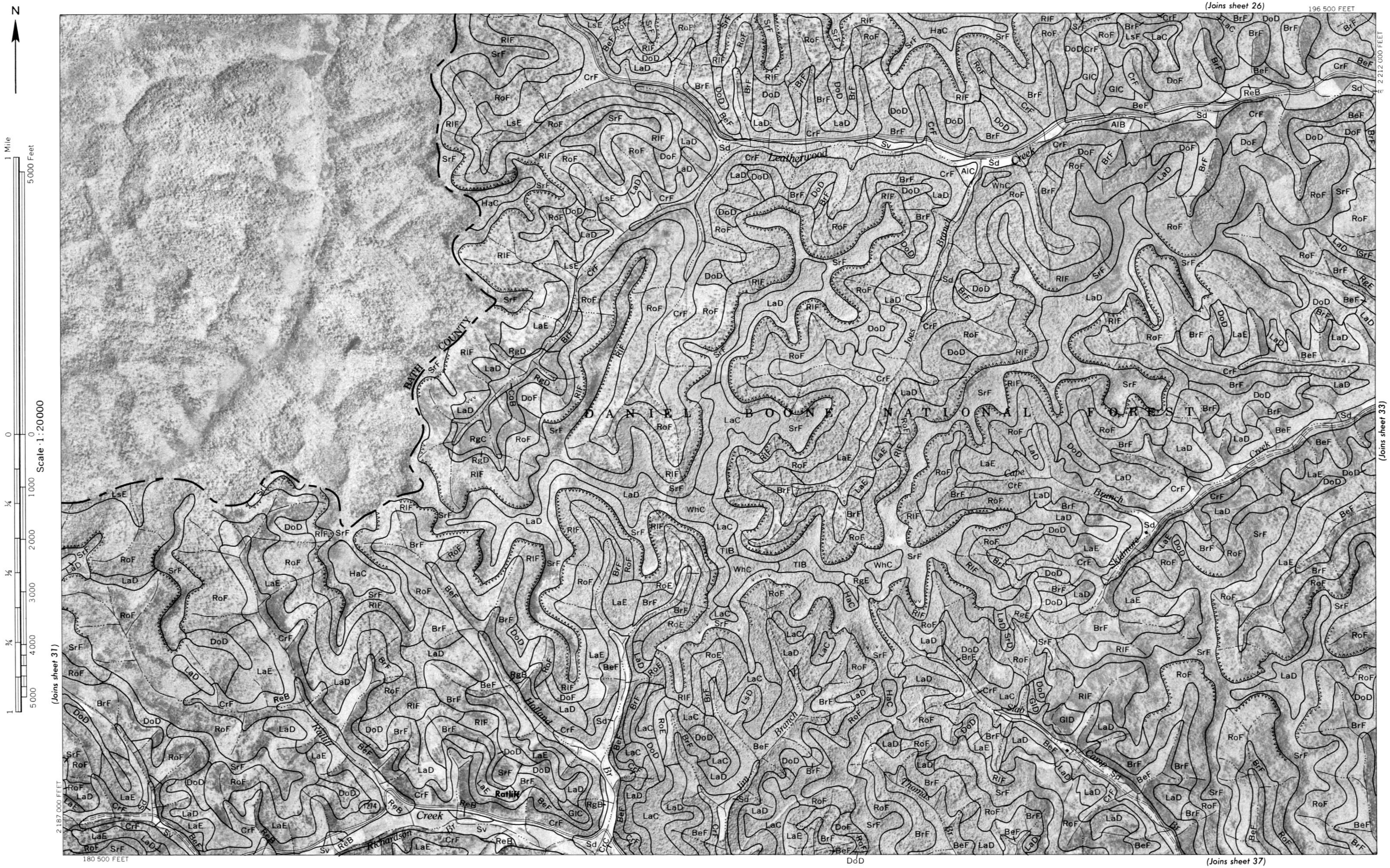
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 31

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

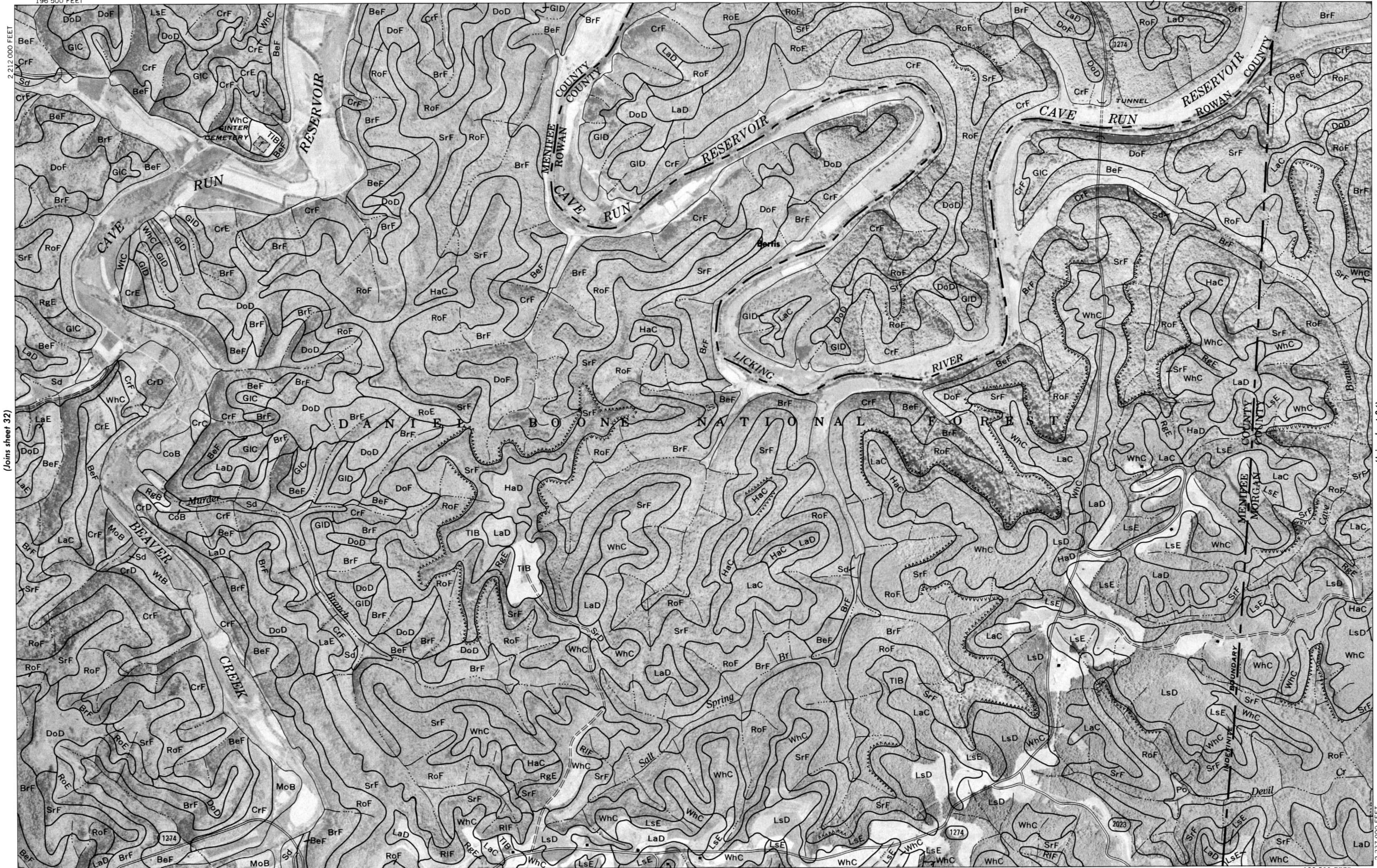


Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

33

(Joins sheet 27)



(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 38)

N

Scale 1:20000

1 Mile

5000 Feet

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 33

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 28)

(Joins sheet 33)

(Joins inset sheet 29)

(Joins sheet 39)

196 500 FEET

2 262 000 FEET

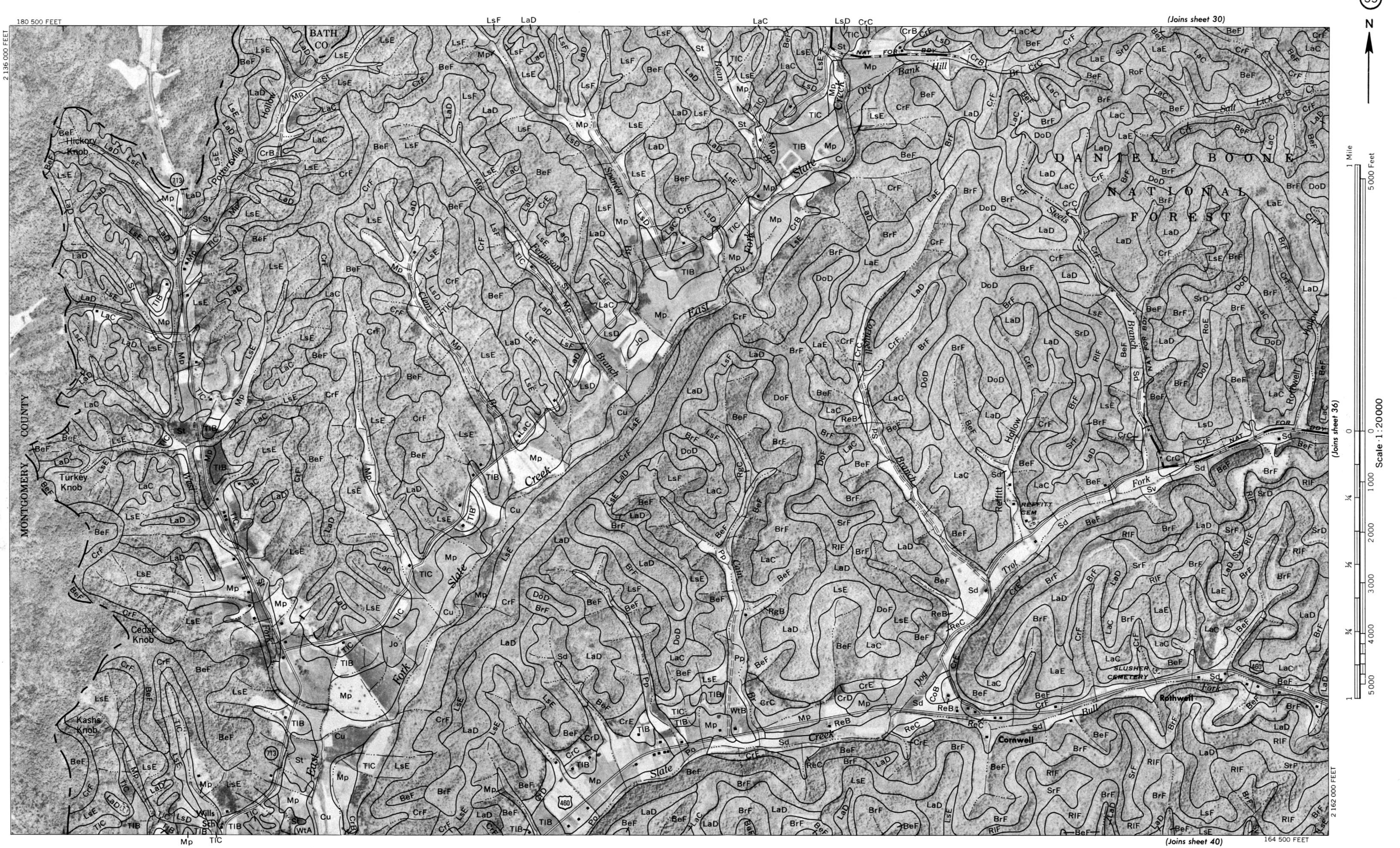
2 237 000 FEET

180 500 FEET

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 34

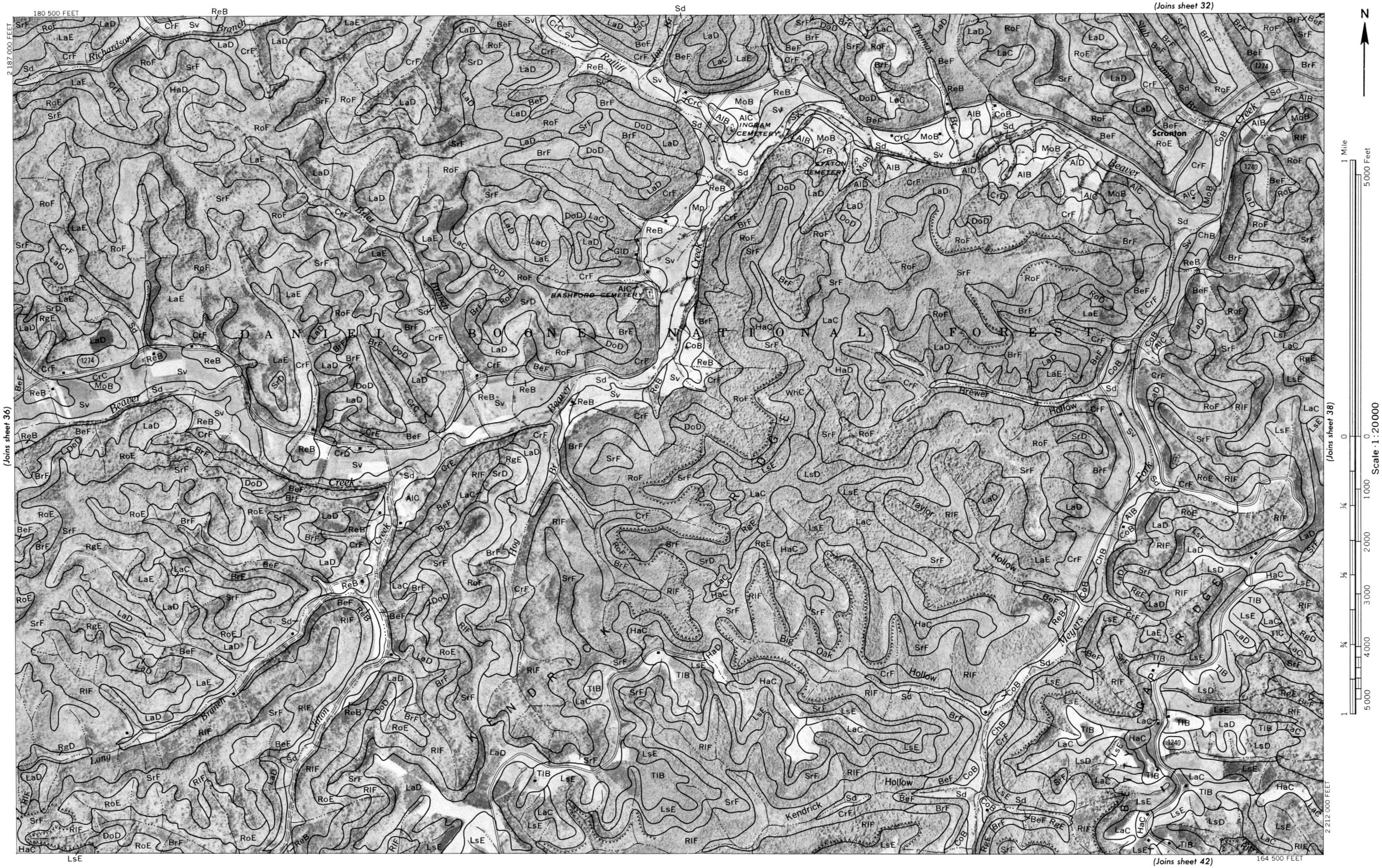
Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 37

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 38

Scale 1:20000

1 Mile

5000 Feet

0 | 1/4 | 1/2 | 3/4 | 1

0 | 1000 | 2000 | 3000 | 4000 | 5000

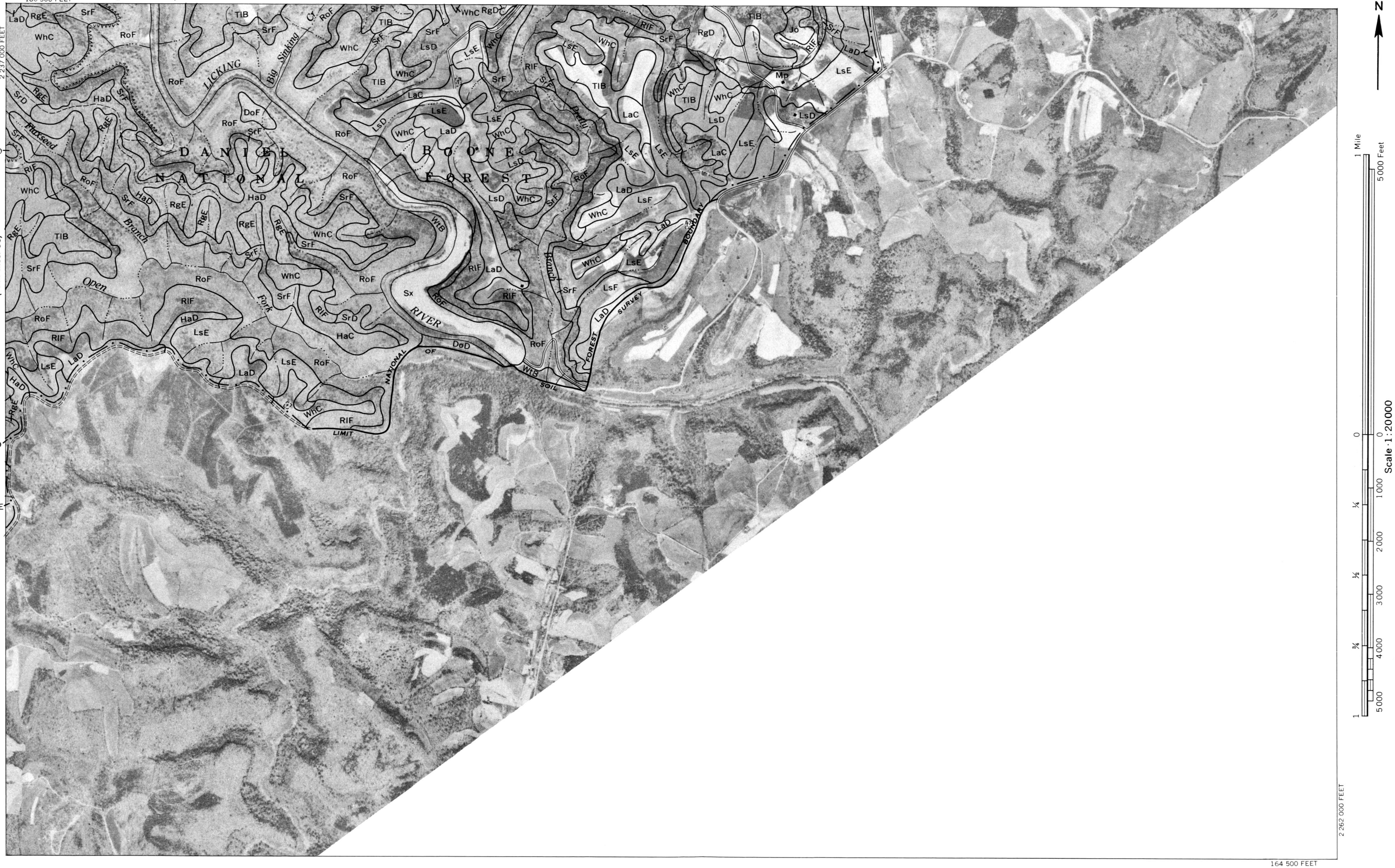
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 38

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 39

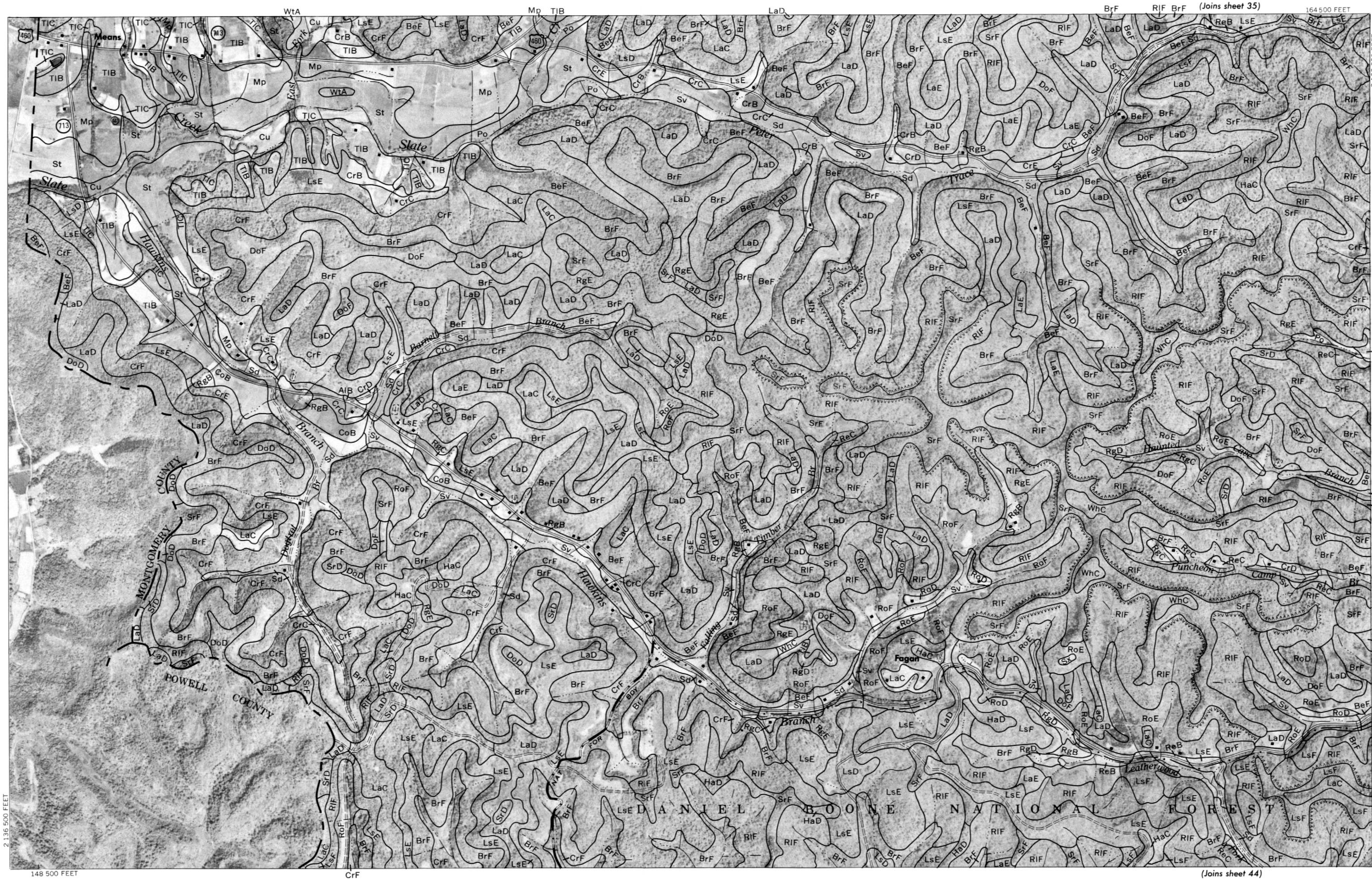
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY — SHEET NUMBER 40

N



1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

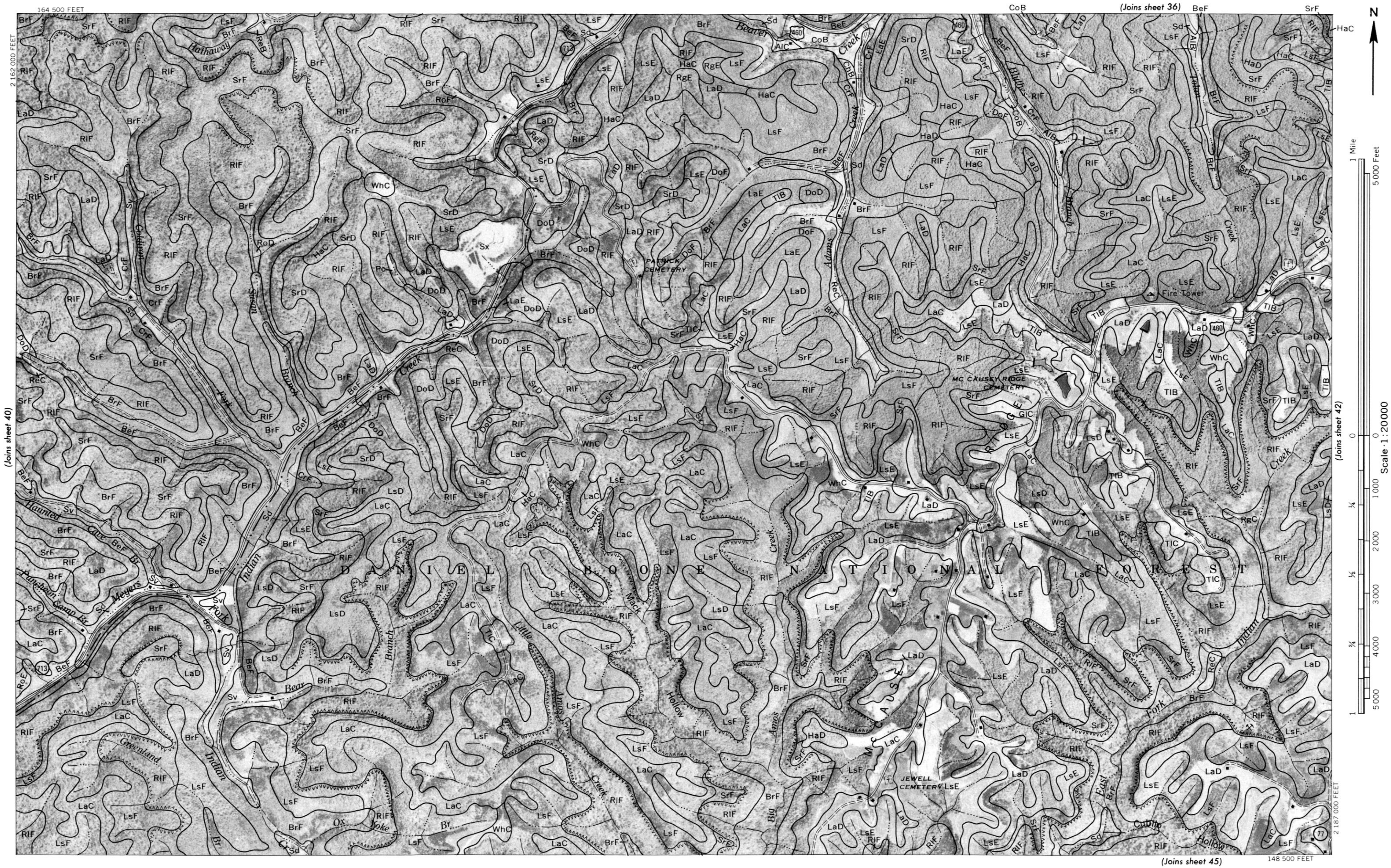
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 40

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 41

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



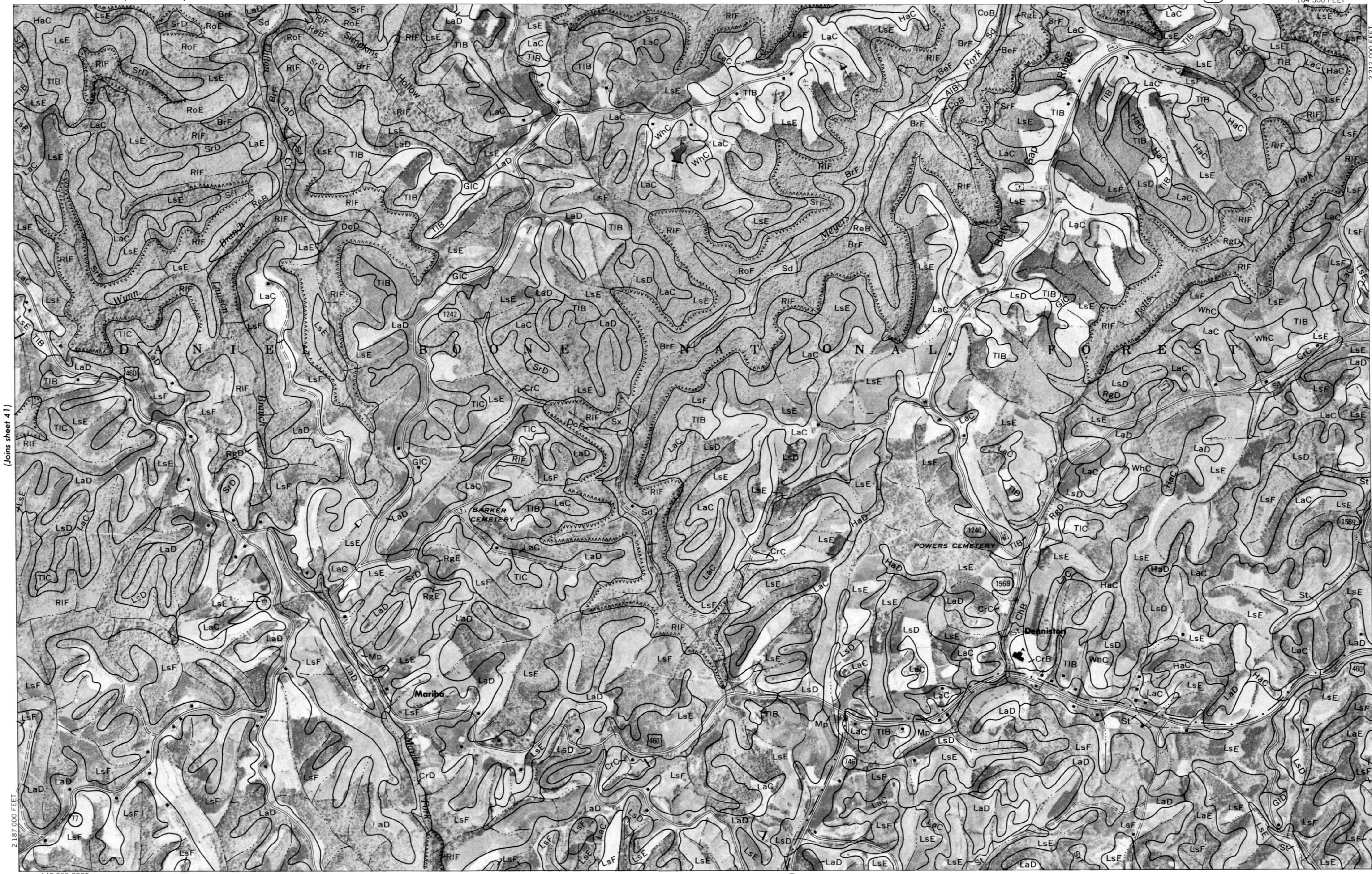
Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

N

(Joins sheet 37)

164 500 FEET

2 212 000 FEET



1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

(Joins sheet 41)

(Joins sheet 43)

2 187 000 FEET

148 500 FEET

(Joins sheet 46)

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 42

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 43

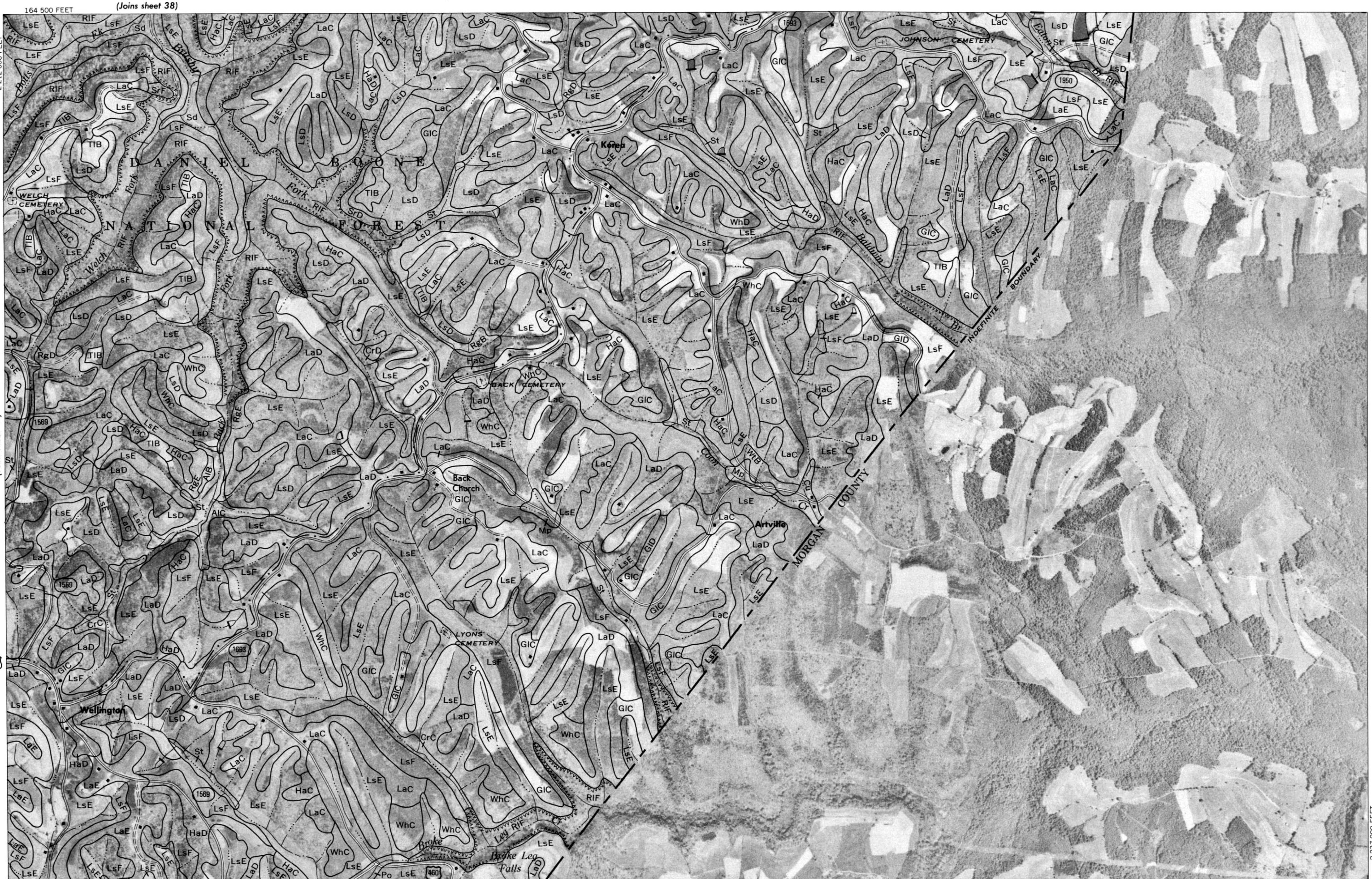
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

164 500 FEET

(Joins sheet 38)

2 212 000 FEET

(Joins sheet 42)



N

Scale 1:20000

1 Mile ¾ ½ ¼ 0

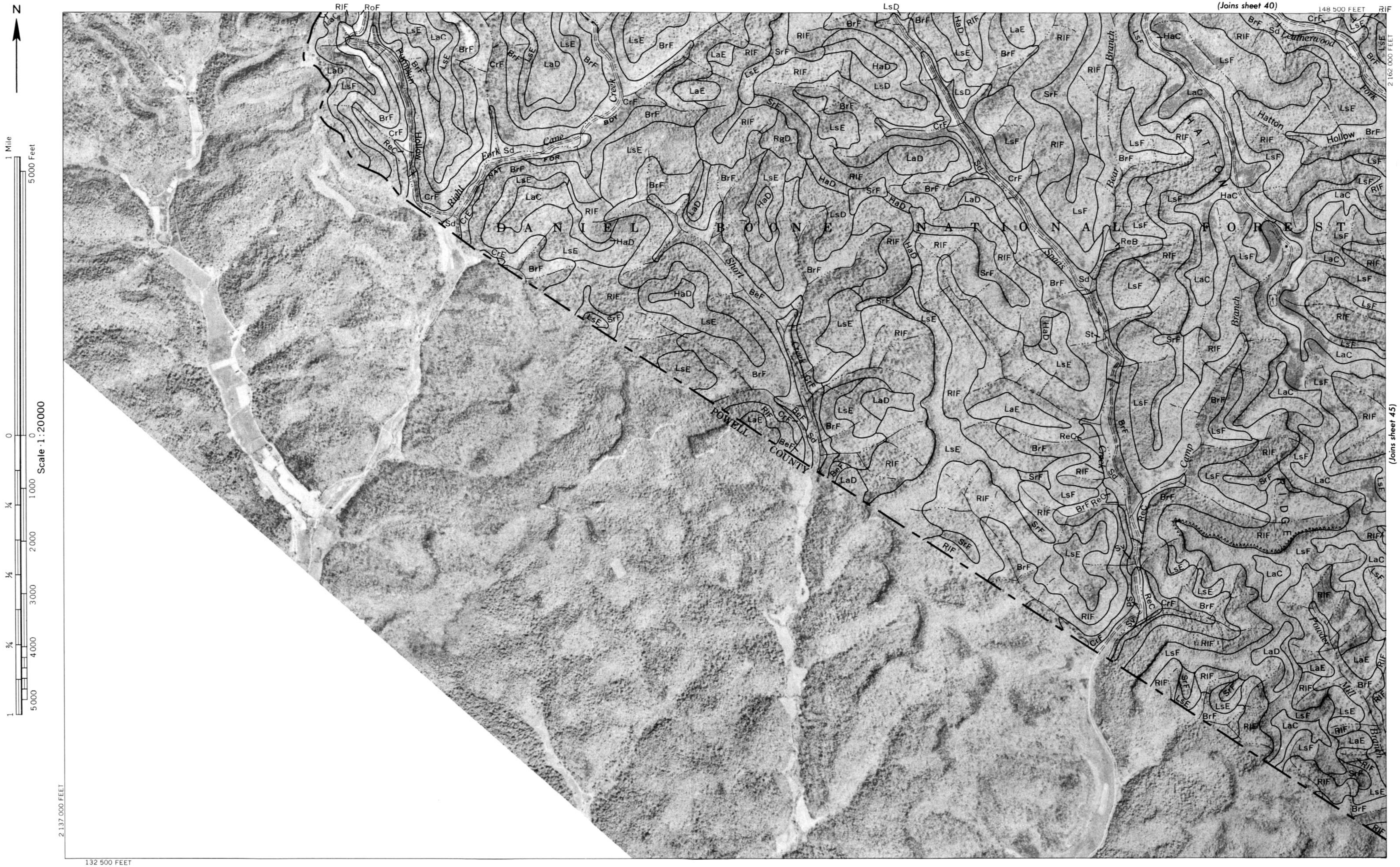
5000 Feet 4000 3000 2000 1000 0 5000

2 237 000 FEET

148 500 FEET

(Joins sheet 47)

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

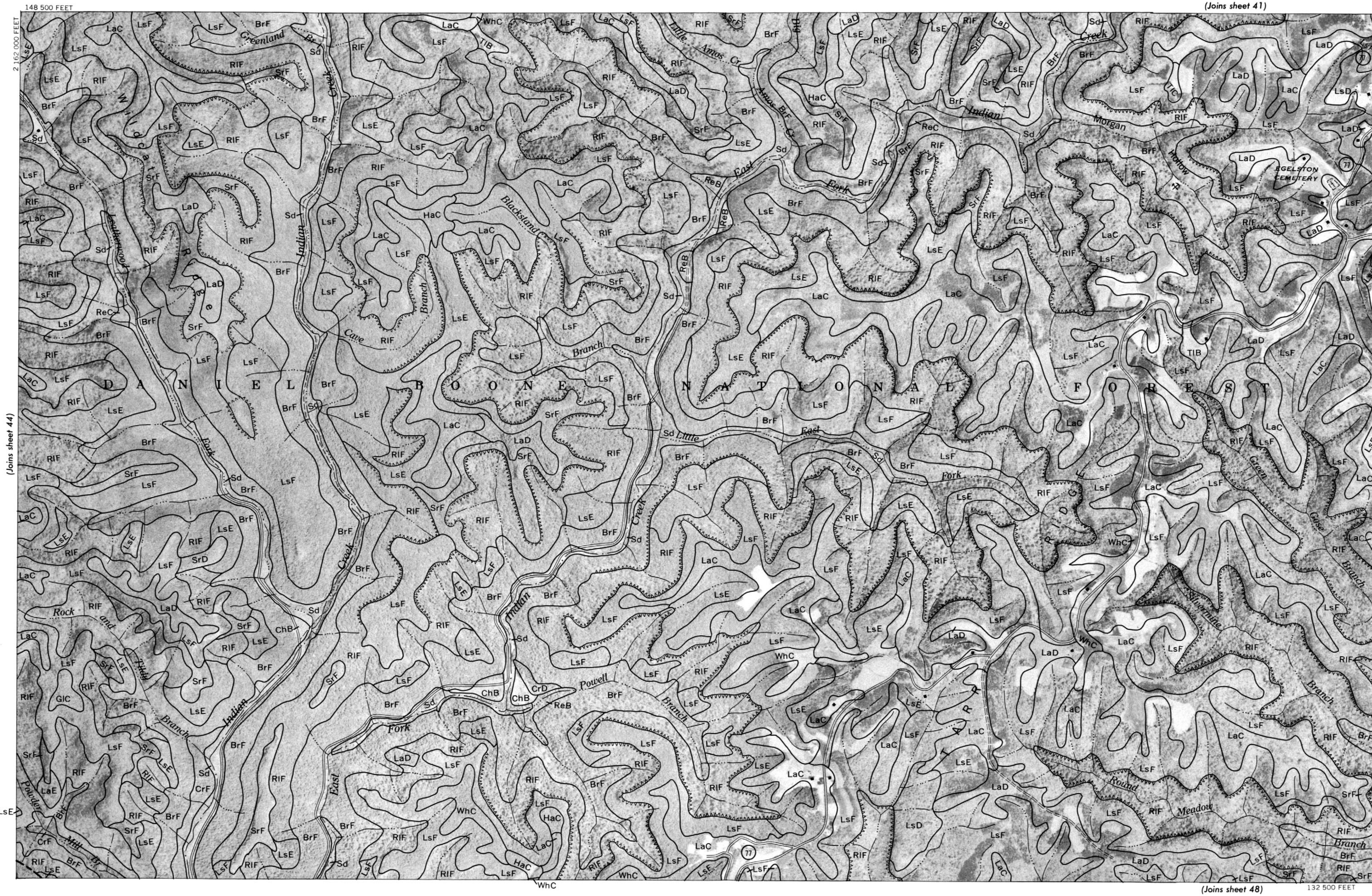


Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 44

45

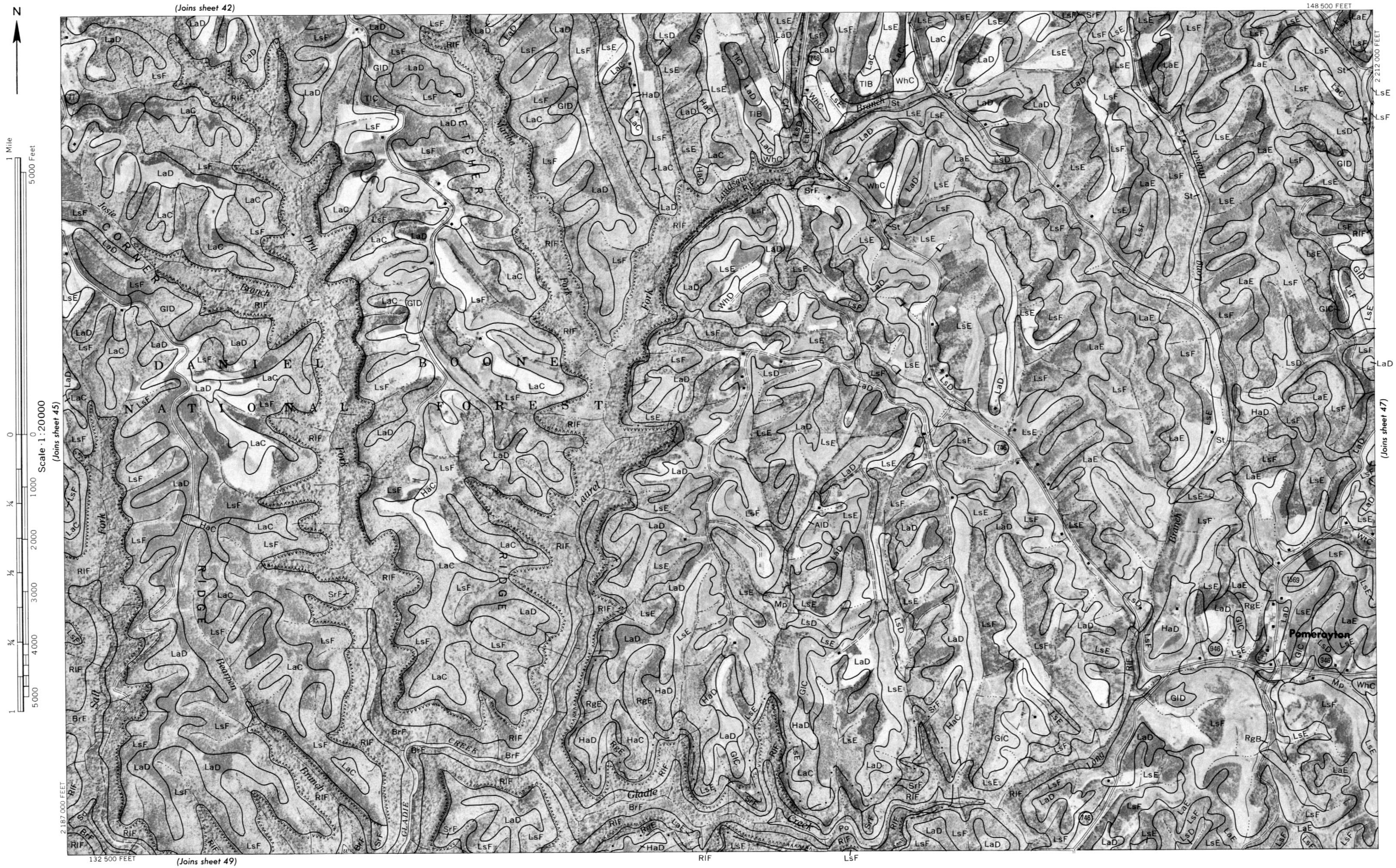


1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 45

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

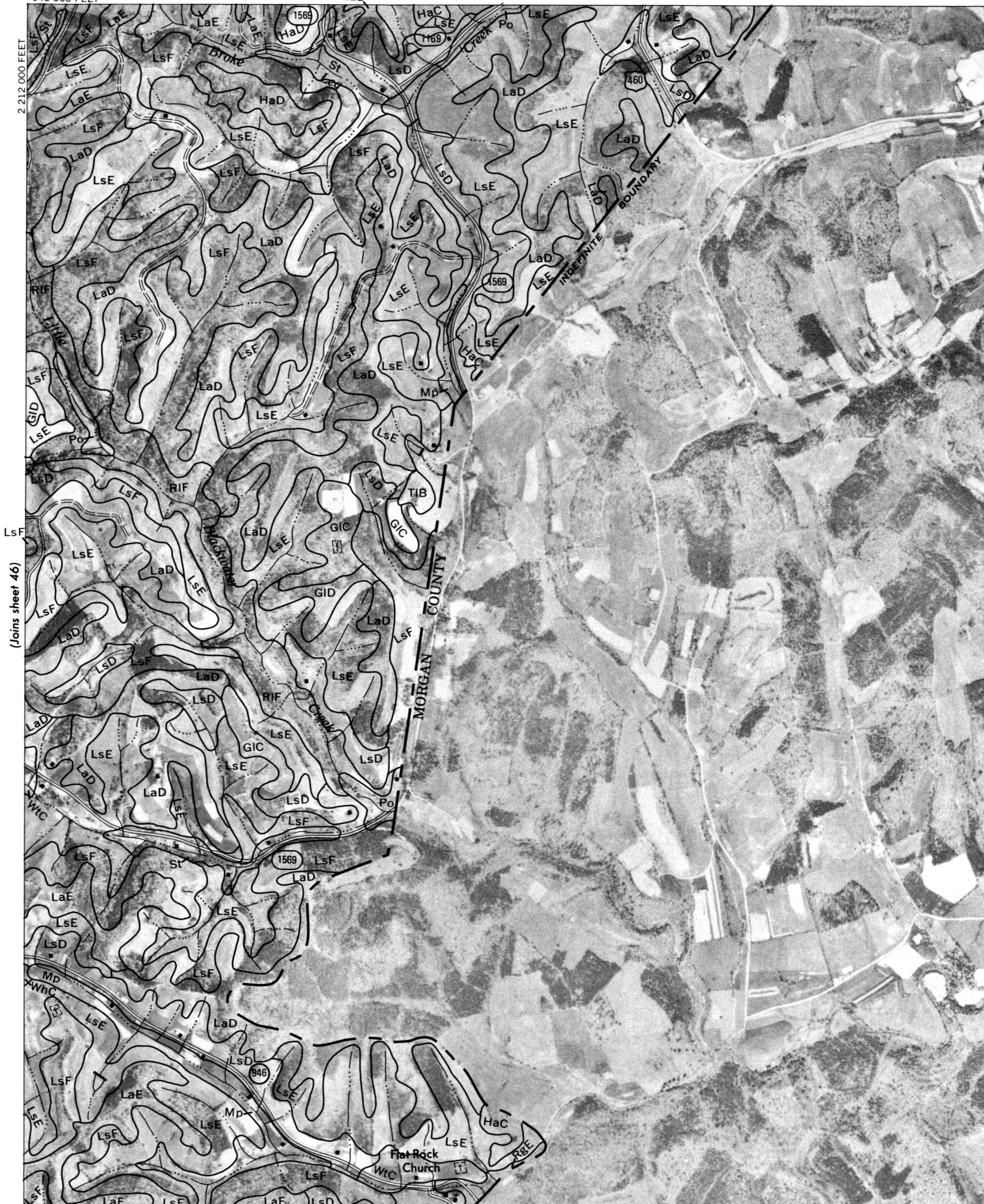


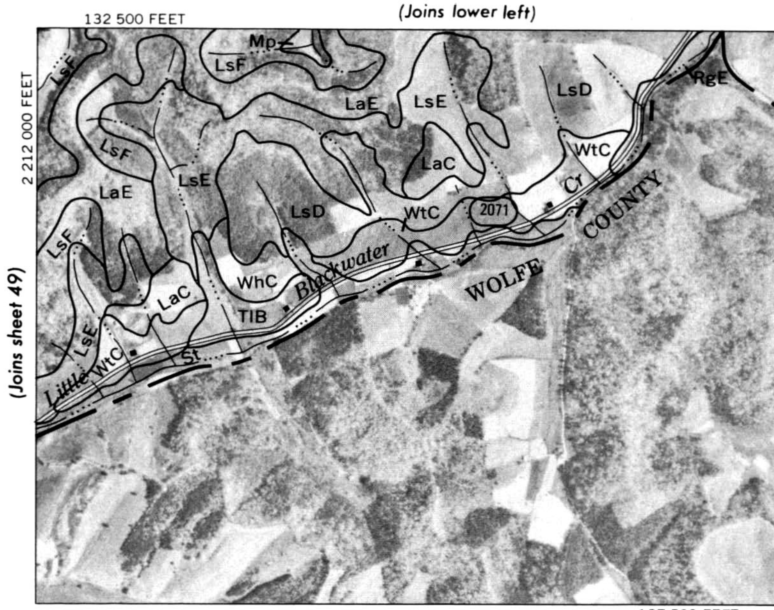
MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 46

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



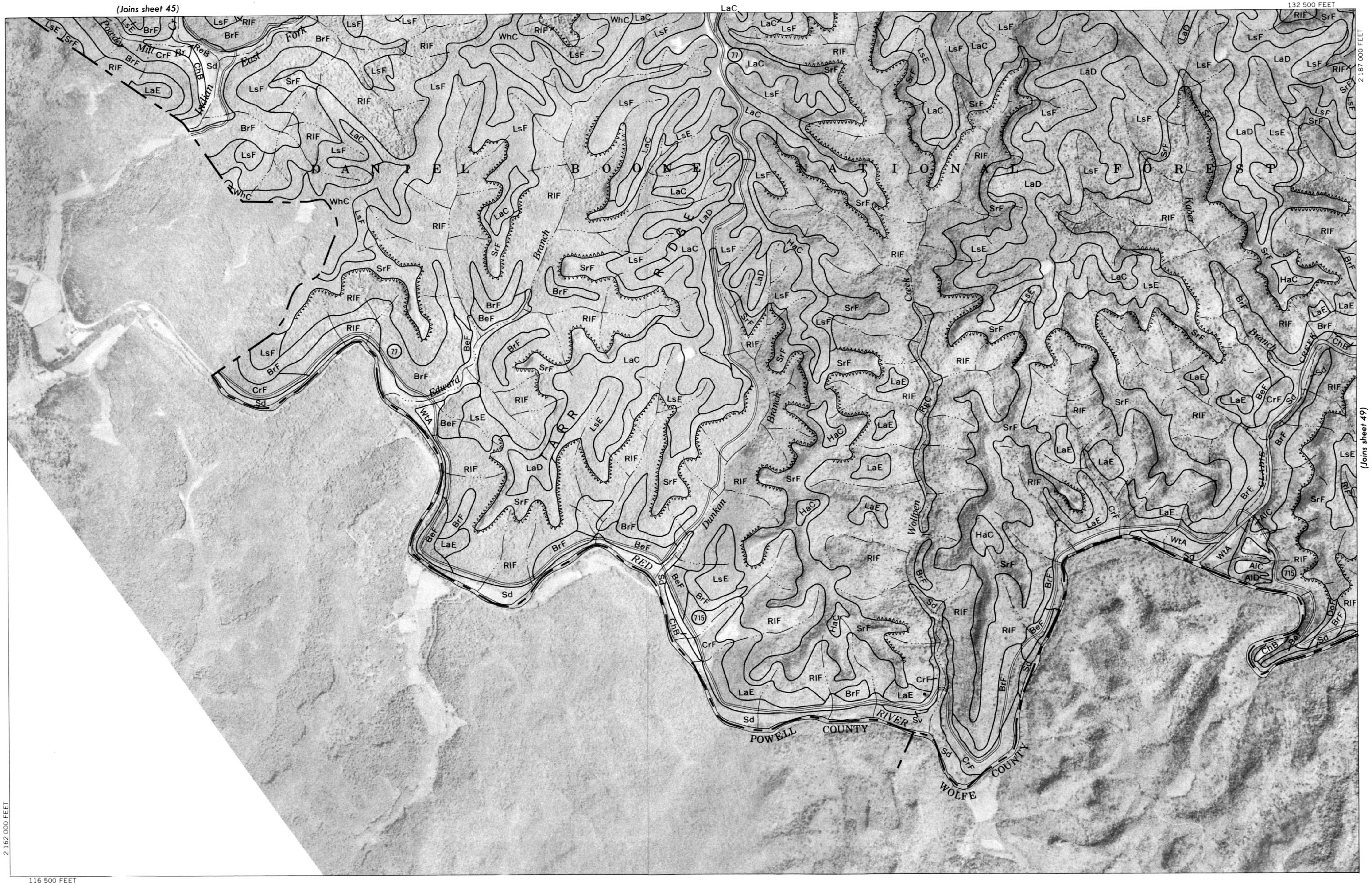


N

Scale 1:20000

1 Mile
5000 Feet

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.



N

Scale 1:20000

1 Mile 5000 Feet 0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

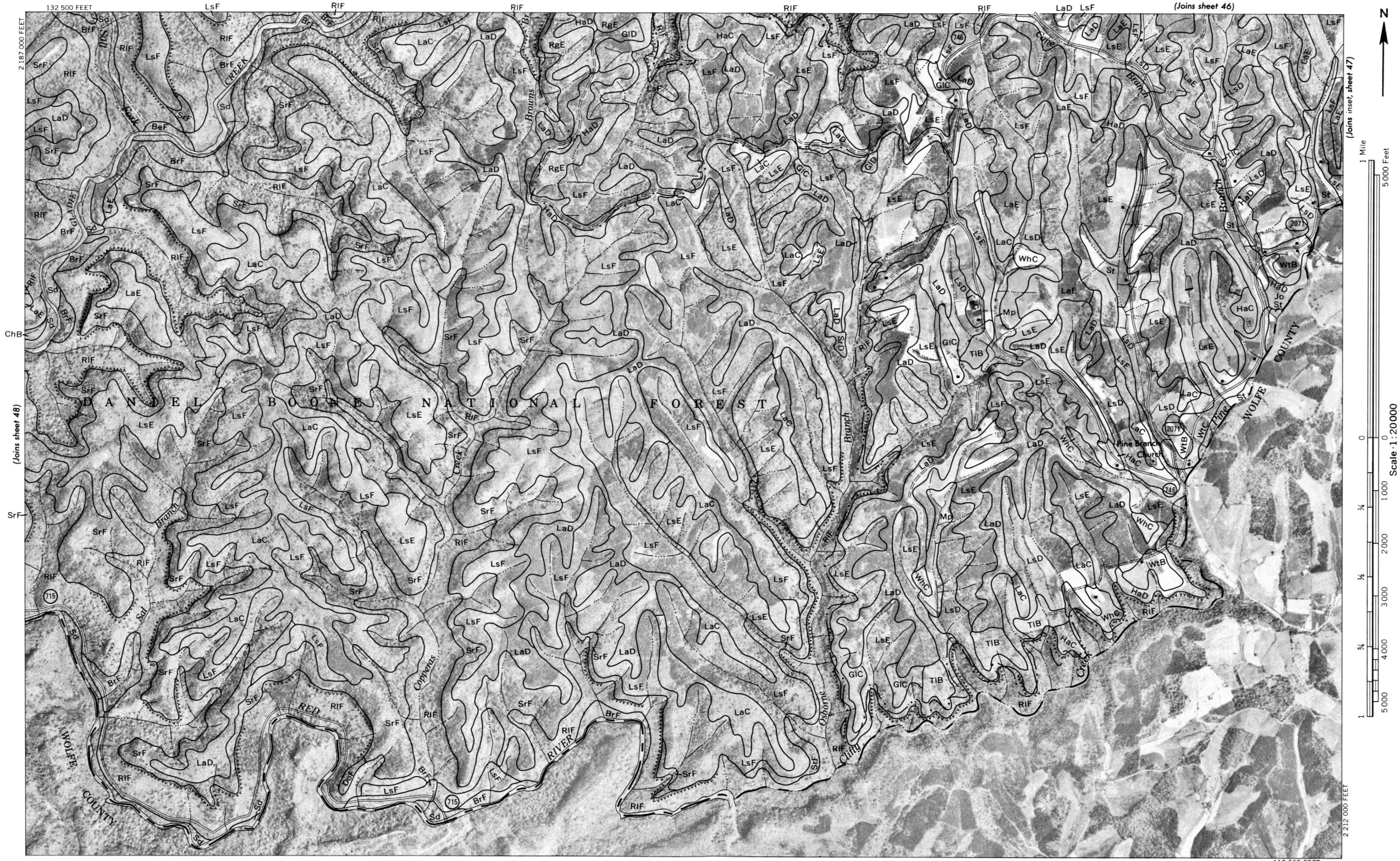
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 48

Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.

MENIFEE, ROWAN AND NORTHWESTERN PART OF MORGAN COUNTIES, KENTUCKY NO. 49

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Kentucky Agricultural Experiment Station.



Photobase from 1965 aerial photography. Positions of grid lines are approximate and based on the Kentucky coordinate system, north zone.